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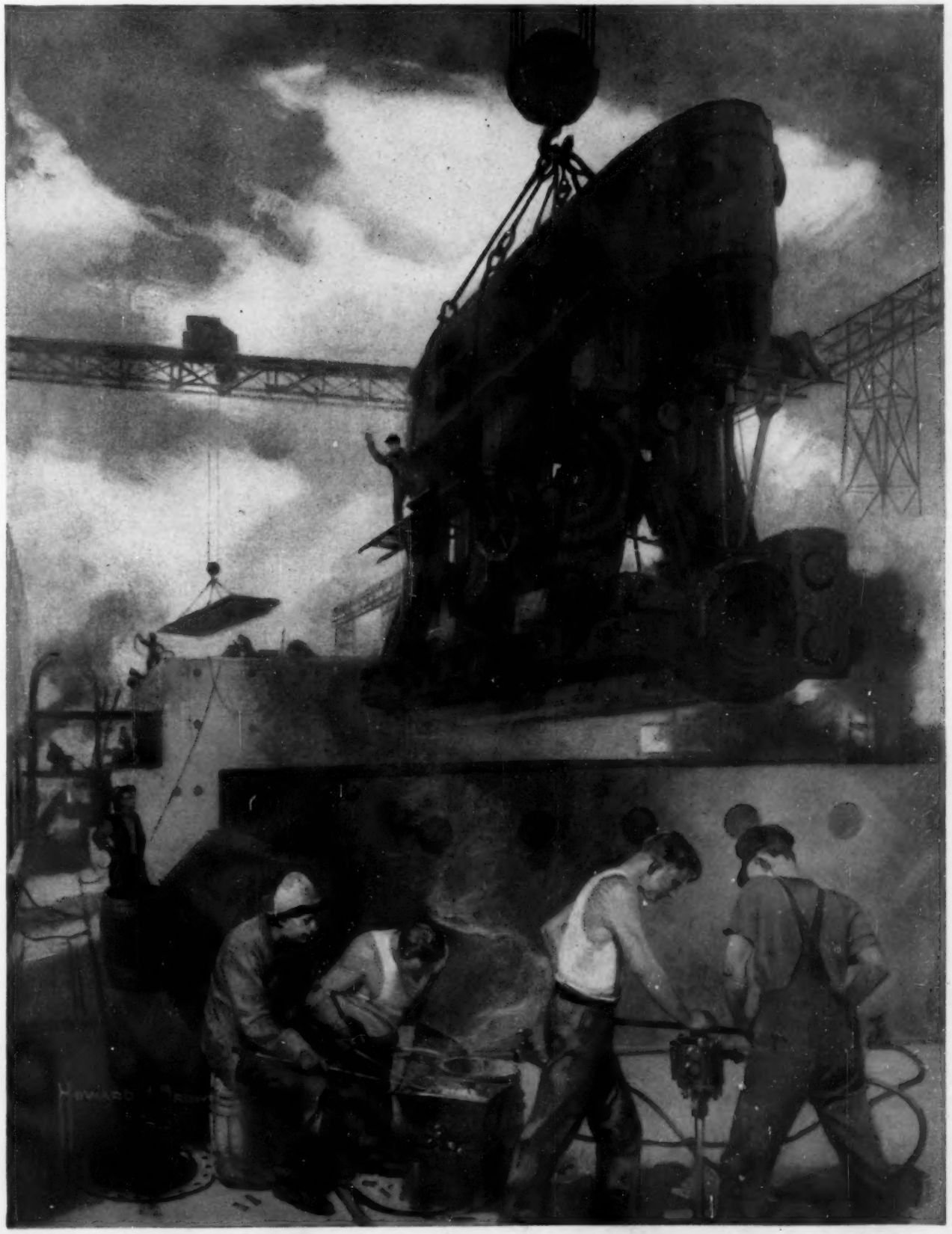
FROM BONEYARD TO SHIPYARD
MAKING FARMS OUT OF DESERTS

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



LOWERING THE ENGINE INTO A STANDARDIZED AMERICAN SHIP

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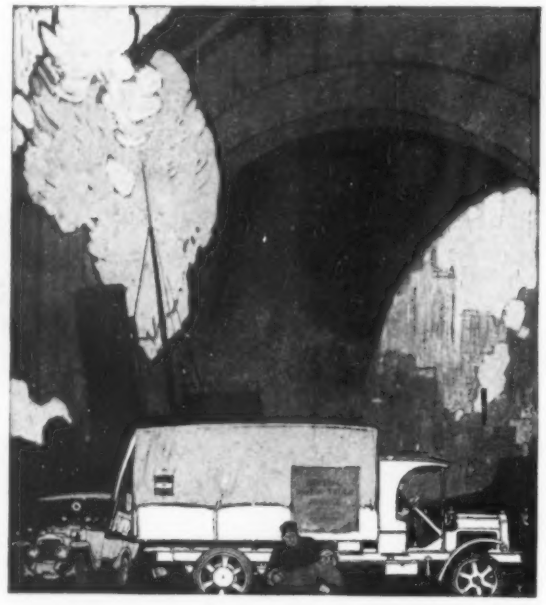


FIRST *in* Motor Transport

MORE than 5000 White Trucks are used by concerns whose sole business is motor truck transportation. They are operated on established routes—express, freight, passenger—in every part of the country.

In many cities White Trucks are the backbone of the largest motor transport fleets. To farms and villages, to mining and lumber camps and oil fields, White Trucks bring rapid transit and quick communication. In our great National Parks they are the standard equipment for passenger and freight service.

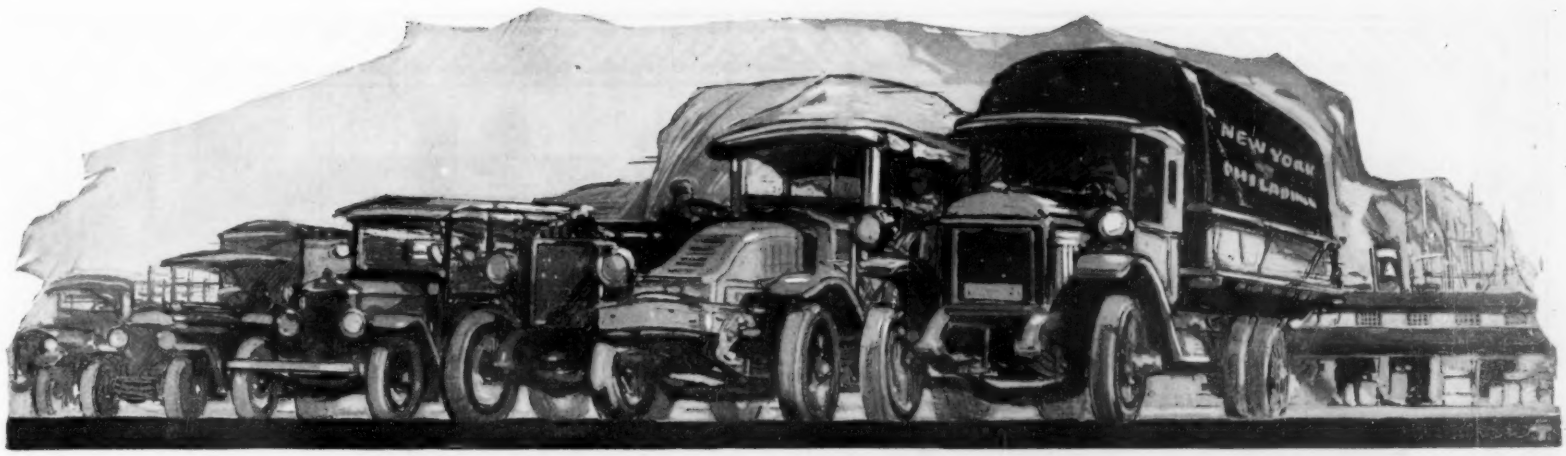
In this service, the mettle of a truck shows unmistakably. Steady operation on exacting schedules, over all kinds of roads in all kinds of weather, is an acid test of endurance. The trucks' *earning power* is the only source of income. Every cent of operating cost is a direct charge against profits. None but the best trucks can do the work; only the most economical can *pay*.

Owners in this field emphasize the "on time" dependability of White Trucks under all conditions, and their low cost of operation year after year. Mileage records are frequent, citing 100,000 to 300,000 miles, the trucks still doing a full day's work. White Trucks go on working and *earning* long after the investment has been charged off the books. They "do the most work for the least money."

The following are some of the representative concerns who operate large White fleets in motor transport service. These fifty companies own a total of more than 1500 White Trucks

American Railway Express Co.
A. L. Ammen Transportation Co.
Akron Storage & Contracting Co.
Anchor Cartage Co.
Atlanta Baggage & Cab Co.
Baltimore Transit Co.
Black & White and Town Taxis
Boulevard Transportation Co.
Canton Storage & Transfer Co.
Cleveland-Akron Bus Line Co.
Cleveland Transfer Co.
Club Cab Corporation
Columbus Transfer Co.
Emerick Motor Bus Co.
Owen H. Fay Livery Co.
Fenway Garage Co.
Glacier Park Transportation Co.
Kennicott-Patterson Transfer Co.
A. C. Marshall Co.
Mesaba Transportation Co.
C. W. Miller Transfer Co.
H. W. Mollenauer & Brother
Motor Terminals Co.
Municipal Railway
Omaha Taxicab Co.
Frank Parmelee Co.
Peninsula Rapid Transit Co.
Pikes Peak Auto Co.
Progressive Transfer Co.
Pullman Taxicab Service Co.
Quaker City Cab Co.
P. Reardon, Inc.
Rocky Mountain Parks Transp. Co.
Salt Lake Transportation Co.
San Francisco Drayage Co.
Dennis Sheen Transfer Co.
Smith & Hicks, Inc.
Stewart Taxi Service Co.
Tacoma Transit Co.
Terminal Taxicab Co.
Twin City Motor Bus Co.
Union Transfer Co.
White Bus Line, Inc.
White Star Auto Line
White Taxicab Co.
White Transit Co., Inc.
Western Auto Stage Co.
Yellowstone Park Transp. Co.
Yosemite National Park Co.
Zumstein Taxicab Co.

THE WHITE COMPANY
CLEVELAND



Economical road transportation depends upon quality vehicles that stand up and deliver mileage

STATISTICS prove that the greatest percentage of truck failures are due not so much to faulty design as to internal part weakness.

The most vital of all internal parts are the bearings. If the bearings wear quickly, the result is misalignment, heating, vibration—early destruction, particularly of transmission and drive.

It is essential, therefore, to secure bearings that not only reduce friction within the power plant and drive, but which wear longest with least necessary attention and no adjustment.

Ball Bearings do this, and almost without exception leading truck manufacturers place ball bearings at the points of greatest possible wear. The best evidence of the value of SKF and HESS-BRIGHT ball bearings is the fact that they are built into the vehicles of the majority of the better truck manufacturers.

In SKF and HESS-BRIGHT ball bearings we have not only developed the anti-friction bearing to its highest perfection, but we have further established a scientific research and engineering organization that is shouldering the automotive manufacturers' bearing problems. We are endeavoring to serve American industry through this contribution to the building of better trucks.

Manufacturers are invited to avail themselves of this freely offered cooperation

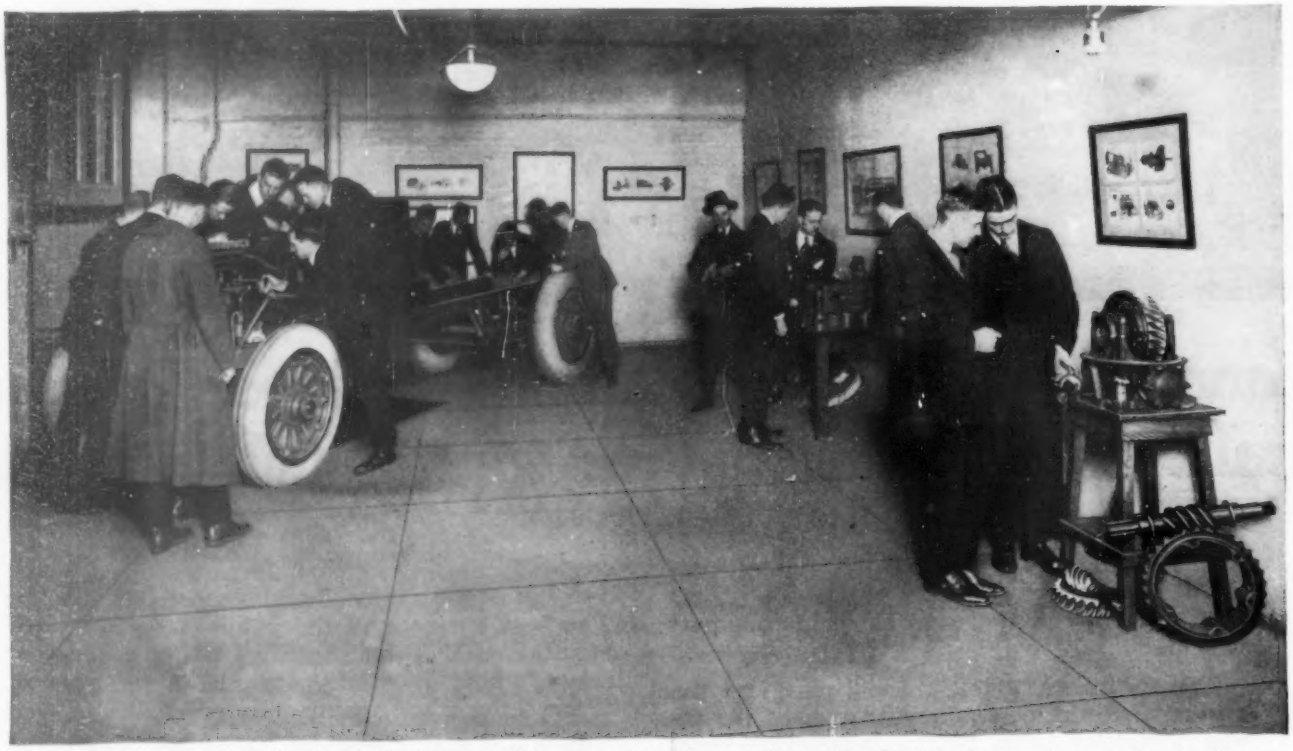
S K F INDUSTRIES, INCORPORATED
Sales, Service and Research Division
165 Broadway, New York

593

SKF INDUSTRIES

Hess-Bright Ball Bearings
S K F Ball Bearings
Atlas Steel Balls
Gronkvist Chucks
Transmission Hangers

The S K F Research Laboratory where friction problems are solved.



Drivers' Conference Room—Packard Service Station. Attended by drivers from all over the Metropolitan District. Owing to the practical engineering and basic economy of the Packard Truck, a week's conferences is usually enough to win a driver his Gold Star and Certificate for Proficiency

The Driver's Experience *vs.* "Features" and "Talking Points"

GIVE the driver a chance, and he will take any amount of trouble to find out a *better way* of handling his truck.

Men drive all day, and then come long distances night after night to the *Packard Service Conference*. The class is always full. There is a long waiting list ahead.

It is unfortunate that the average driver's efforts to keep his costs down are so often thwarted by the *truck* he is given to work with.

THE following National Standard Truck Cost System facts on the performance of over 1700 Packard Trucks in 1919 have a *vital significance* for the truck user.

An average *saving in gasoline* of 10 per cent—due to greater efficiency in operation with the aid of the National Standard System.

The National Standard System used in connection with Packard Trucks has shown it possible to reduce cost per ton mile.

Truck owners who have used the System for a year or more, and have compared the Packard with other trucks, are standardizing on Packard.

The driver finds the Packard easier all around to handle.

Less vibration because of the smooth-running Packard engine, the construction of the worm drive, and the placing of 85 to 95 per cent of the live load on the rear axle.

Less strain at the wheel, owing to the Packard semi-irreversible steering gear.

Easier handling on the hills, owing to Packard high tractive force on the road and four-speed transmission graded up by even steps.

Easier to keep clean. Engine enclosed, and lubricated automatically. Fly wheel and clutch shut off from dust and mud.

THE man who is in doubt what make of truck to buy might well ask his *driver's* advice.

It may surprise him to learn the positive Packard opinion among men who judge a truck solely by what it will *do*.

"Ask the Man Who Owns One"

PACKARD MOTOR CAR COMPANY, *Detroit*

SEVENTY-SIXTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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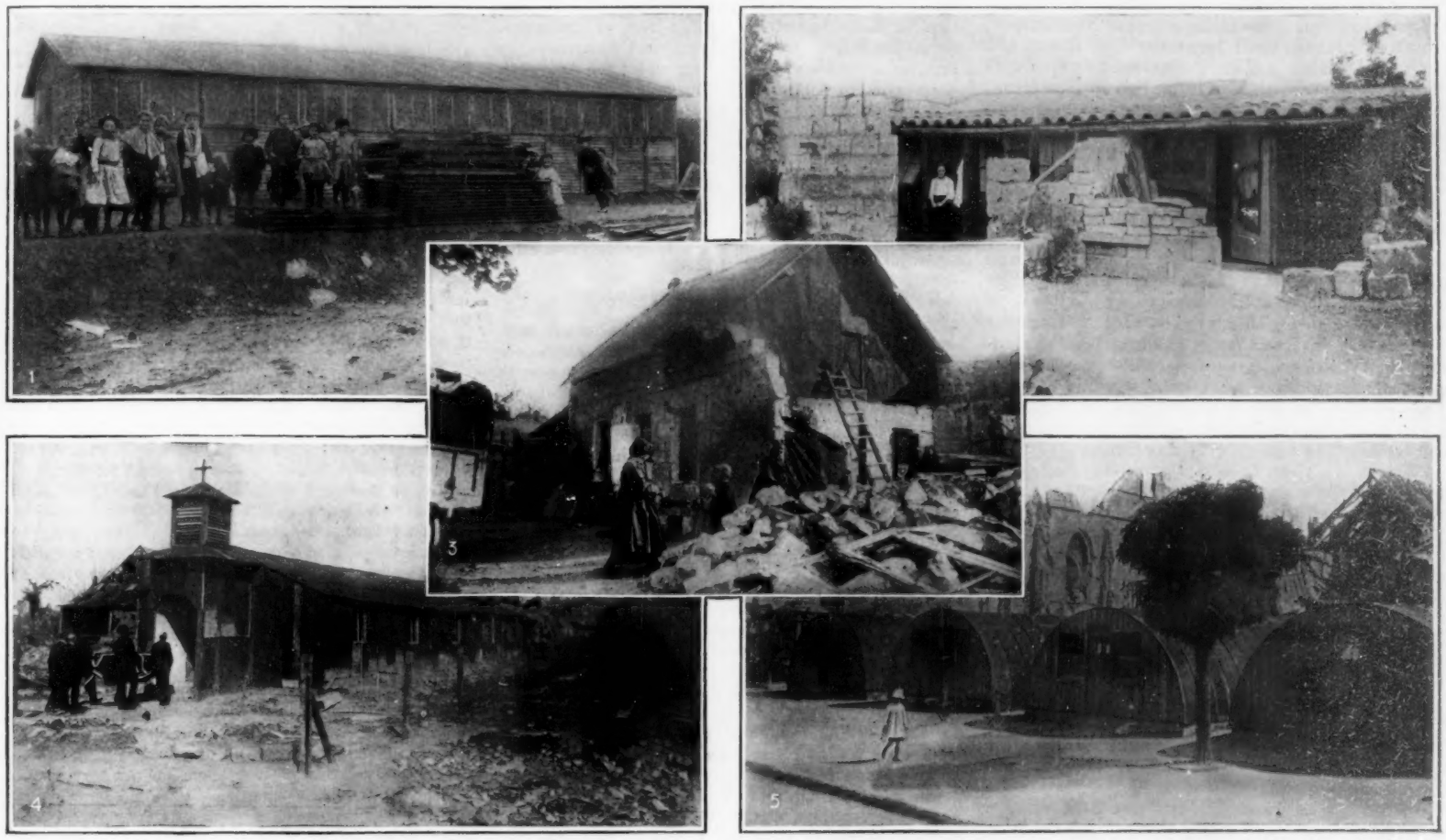

1. A typical French school in the devastated region, made of scrap lumber. 2. A dwelling of salvaged lumber at Coucy-le Chateau. 3. A farmer's attempt to repair his farm house for the time being. 4. A country church of scrap corrugated iron. 5. A row of former British "bee-hive" huts at Peronne.

Some of the improvisions which are giving shelter to Europe's war victims

Building Houses Out of the Waste of War

IN view of the war that is now raging in certain parts of these United States between the tenants on the one hand and the landlords on the other, the accompanying collection of illustrations is of more than usual interest. For these views represent a different side of the housing question—that side which has to do with housing people where houses have ceased to exist.

When the refugees poured back into the devastated provinces of northern France, they found little but one ruin after another, plus the general havoc and filth of war. They appealed to the French Government for aid in rebuilding their homes and shops and villages; but the French Government, facing numerous difficulties and new conditions which taxed the nation to the utmost, found itself unable to extend much aid to the devastated regions. Suffice it to state here that the people of northern France have had to shift for themselves as regards housing accommodations, for the authorities could do little more than clear away the debris of the late armies.

The accompanying views are certainly interesting, for they contain more description than mere words could convey. Note the school house built of wood salvaged from army huts; a dwelling put together with rough boards and topped with corrugated iron sheets; an old farm house hastily patched up with boards and tar paper; a church made up of scrap corrugated iron; and a row of former British army huts, known as "beehives." All these methods and as many more are being resorted to in housing families left homeless by the destruction of at least 60,000 houses, not to speak of the schools, churches, public buildings, shops and so on.

Rust-Proof Steel in Dentistry

AT a convention of German dentists which was recently held at Jena one of the members spoke on the use of rust-proof steel in dentistry.

This rust-proof steel, highly alloyed with chromium and nickel, has been put on the market by the house of Krupp. It is protected by patents. The steel is remarkable for its high power of chemical resistance to corrosion; it is excellently suited for mechanical purposes since it possesses an extraordinary toughness. The fine qualities of this new form of steel became evident especially during the war.

Hauptmeyer, the lecturer, has tried to use the steel in dentistry, for it not only equals gold and platinum in mechanical value, but it even surpasses these precious metals in regard to power of resistance to chemical influences. Especially good results are promised in the manufacture of instruments with edged surfaces which have to be sterilized without injury to the edge. The surface of the rust-proof steel acquires an intense brightness from polishing, and it may therefore be used for mouth and throat mirrors. For the purpose of fastening artificial teeth in rubber the steel will probably also become a valuable substitute for platinum and gold which are now in use. The rust-proof steel may be drawn into fine wire. On account of its elasticity and firmness even dental plates may be cast from the steel, the weight of such a plate being just half that of a gold plate made from the same impression.

A Light That Failed

THAT even conservation needs to be carried out with some degree of care is shown by a recent experience in France. Matches are so scarce here that their sale is a state monopoly, the government doling them out at a rate of a cent for a score or thereabouts, and not guaranteeing them to strike on the box or indeed, anywhere else. At the present time Paris is annoyed over the appearance of a particular brand, in which, though it "strikes," eighteen times out of twenty, the flame fails to fire the wood. Complaints have been so general that the authorities instituted an inquiry into the cause, when it was discovered that someone infatuated with the craze for utilizing every form of waste had supplied the matchmakers with loose ends from a shop where military huts were constructed. It was commendable enough thus to work up the stumps, but no one had remembered that the timber had been impregnated to render it fire-proof.

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Notice to Our Readers

OWING to snow-bound conditions and shortage of freight cars, it was not possible to ship the paper for our issue of March 27th from Maine, where it is made, until two days after it was due in the pressroom in New York. As no paper sufficient for the edition was to be had in New York, printing and mailing were several days late; and the present issue will likewise be affected.

Getting Together

IT is gratifying to find that in the midst of the present discursive discussion of labor and production problems there are some men who have realized that the time is ripe for a little more doing and a little less talking, and that the best way for capital and labor, employer and employee to get together is to get together. In certain centers of industrial activity this has been done, and the results have been so gratifying that one of the many plans of industrial coöperation, or a new organization embodying the best elements of them all, may well prove capable of quieting the present unrest and placing capital and labor upon a permanent basis of friendly coöperation.

We have all understood that something was being done in the direction of industrial coöperation, but it will be news to most of us that in one city of the Middle West, Cleveland, no less than four carefully-thought-out systems are in use and are giving excellent results. Although these systems differ widely in their methods, the fundamental objects are the same; and that they are getting results is shown by the fact that in those organizations which are operating under this broad principle of mutuality, strikes are practically unknown.

The oldest and most thoroughly tested scheme is that of a well-known motor-truck firm, a scheme which has been in continuous and successful operation for over five years. Ask any executive of the concern to what he attributes the success of the system, and he will tell you it is due to the fact that the books are open and the operations of the company are disclosed in their entirety to the employees, and that the scale of wages is determined by the prosperity of the concern. A minimum dividend of eight per cent is payable on the capital stock, and any profits above that are applied largely to an all-round increase of wages. This company believes that all benefits to labor should come in the form of a straight week-by-week wage—not in the form of so-called profit-sharing or bonuses, or mutual-benefit schemes, none of which are practised by the company. In proof that their plan is practical and effective, they point to the fact that throughout the stress of the war and the period of reconstruction they have been free from strikes or any form of labor trouble.

As distinct from this, another plan, which is also working satisfactorily in the case of several large plants, includes a straight wage, with a certain percentage of the profits set aside annually, and given to the employees in amounts proportioned to their years of continuous service.

Unique among the various industrial relationship plans is one which takes the Constitution of the United States as its model. This, like nearly all of these movements, is entirely in the hands of the employees. The organization has a Senate, a House of Representatives, and a Cabinet. A President is elected and in the particular case we have in mind the employees voluntarily elected the president of the company as president of their organization.

A recognition of the advantage of coördinating the efforts of the various industrial concerns that have adopted coöperative methods has led to the formation in the city of Cleveland of an Industrial Association of employers and employees whose objects, as stated in the preamble to its constitution, are: To effect greater coöperation between employers and employees; to establish justice and equity in their mutual relations and dealings with each other; and to promote the mutual education and common welfare of employers, employees and the general public.

Finally, it should be noted that in all this movement these is evidence of a very sincere effort on the part of the executives to get into close personal contact with and understanding of the employees, not merely in the shop but in the home. The president of one large concern has recently said that he believed the employer's lack of real understanding of how men think and feel often lies at the root of disloyalty. Hence his firm has created a personnel department, so that its activities are carried on under the four divisions of production, sales, finance and personnel.

We think it will be agreed that, whatever may be the ultimate plan that will be adopted for nation-wide activities, the right keynote has been struck in these efforts to bring capital and labor into harmonious coöperation. Several leading concerns state that production has already regained its pre-war level, and in two cases it has exceeded it respectively by as much as ten and fifteen per cent.

Laws as a Source of History

WE are always amused when we hear it said, of some period like that of Khammurabai or Moses, "Oh, they were highly enlightened in those days; their laws prove it. Why, . . . " followed by a more or less complete enumeration of the things which the code in question forbade. The enthusiast of the type quoted never seems to ask himself why such laws were put on the books.

The study of history has been revolutionized greatly within the past century—surely as much so as has any other field of human thought. Our ancestors thought in terms of princes and potentates, and were satisfied that they had a reasonably complete account of a nation's history if they were able to construct a list of rulers with their dates. We of today are vastly more interested in knowing how business was conducted in Mesopotamia four thousand years ago, what the population in general got to eat and to wear, than we are in knowing just how many of his enemies from across the mountains the wise and good king slew with his own hand, or the exact dates of his accession and death.

One of the great sources for data of this sort, so valuable in reconstructing the life of a past epoch, is to be found in the laws of the period. But the method of the modern historian in interpreting these would bring amazement to his predecessor of several generations back. Today we do not argue that since the laws of a given people prohibit adultery and bigamy they were essentially a pure-minded race, venerating the marriage tie; because thievery was punishable with extreme severity we do not conclude that here was a golden age, when a man could leave his valuables on the public highway overnight and find them in the morning unmolested. In fact, our viewpoint is quite the contrary.

Barring the eccentric demands of certain religions, the economic conditions that lead to the acceptance of slavery, and the fact that different races disagree as to the number of persons with whom a single individual should have marital or pseudo-marital relations, right and wrong is pretty much the same throughout the world and for all time. Everywhere it is recognized that a man's property and his life are his own, and that to deprive him of either by violence or fraud is to injure him. We may differ as to whether the remedy lies in the hands of the injured party or of the community; but the fundamental bases of right and wrong are universal. Under a given set of circumstances, the legislative machinery of ancient Babylon and that of modern America will therefore turn out products differing in phraseology but similar in general content.

The laws of a given period, however, are enacted not to give satisfaction to an innate impulse of the human mind to legislate, but rather to meet a condition. In other words, if Khammurabai's code places emphasis upon the penalties for adultery, for murder and for false statements in business negotiations, we may be perfectly sure that this is done, not because these particular varieties of crime especially offended the Sumerian sensibilities, but solely because at the time the law was passed adultery, murder and deceit constituted the more prevalent crimes. If we pass to the France of the *Ancien Regime* and read the numerous and severe penalties that were provided for the tax-dodger, we assume, not that tax-dodging was highly repugnant to the subjects of Louis Quatorze, but merely that it was a popular sport among them. If we read the Declaration of Independence and the Constitution of the United States, we shall find hidden away in them a record, not of those forms of oppression that struck the colonial conscience as particularly reprehensible, but merely of those forms that experience had taught them to look for from an irresponsible government.

Sound history will always learn in this way, by a study of the laws of a given period, what were the particular vices of that period. These remarks are inspired by a case right here, in the present time and place. The Legislature of New York State is in violent consideration of a large number of measures designed to protect the lease-less tenant from his landlord, and a good many of these measures will doubtless become law. A thousand years from now are we to hope that the historian of the thirtieth century will exhume these enactments from their resting place, and moralize upon the high ethical character of twentieth century civilization, as shown by the great repugnance with which this sort of extortion was viewed? We are sure he will do nothing of the sort; we are sure that he will say, "Ah; I perceive that in 1920 an epidemic of exorbitant demands upon the tenant by the landlord came to such a crisis that it had to be checked; I must see if I cannot deduce the economic conditions which brought this about." By the laws that we pass our morals are measured; but indirectly, rather than directly. The laws we *have* to pass show clearly the current abuses that we have to meet.

The Mathematical Practitioner—Why Not?

PROBLEMS come up in practically all technical fields for the satisfactory solution of which the expert application of mathematics is essential. A differential equation is to be solved, or a probability to be estimated, or perhaps it is so elementary a matter as the solution of a triangle or the formulation and discussion of an equation. It would be easier to find a problem in machine design or aeronautics or in many other technical fields which involves such use of mathematics than to find one that does not. Yet for some reason, while the directors of industrial enterprises do not hesitate to call in the consulting engineer, the consulting chemist, the patent attorney or the efficiency expert, the mathematical features of their problems are all too frequently left without adequate treatment.

We are sure that this is due neither to a reluctance on the part of industrial managers to consult mathematicians, nor to actual lack of desire on the part of the mathematicians to handle industrial problems. It is in large part purely an accident, and is so merely because it has always been so. The industrial executive does not realize that there are places to which he can go with the certainty of getting expert mathematical aid; and the members of our university faculties who are capable of extending such aid are behind their colleagues in other departments in that they have not yet discovered the potential demand for their services. More than any other section of the university, the mathematical section has lived in a world apart, a world isolated from material contacts.

We know of no case where a mathematician has deliberately sought to set up a professional "practice." We know of but two cases where the party needing mathematical advice has set out intelligently to receive it. Surely there is a cog loose here which ought to be tightened.

Electrical

China Plans for a Great Hydro-Electric Development, according to a Chinese purchasing agent who recently arrived in this country in search of equipment. "The big hydro-electric plant will be built in the province of Szechuan, making use of the enormous power, hitherto wasted, of the Yangste rapids," states this authority. "Our electrical project will be the first step in the gigantic operation of harnessing the water power in the Upper Yangste, whose potential power is far in excess of that of Niagara Falls."

Convenient Dry-Cell Battery.—One of the leading manufacturers of dry batteries has answered the call for convenient, waterproof batteries for ignition and other purposes. Standard-sized dry cells insulated from each other and hermetically sealed in one container go to make a convenient unit. Only the terminal nuts project through the sealing compound. These nuts are plainly marked positive and negative and are covered with an insulating knob which is easy to handle and prevents accidental short circuit by metal objects laid across the top of the battery.

Wireless Experiments of Note.—Several weeks ago experiments were conducted by the Radio Compass Research Laboratory at Philadelphia Navy Yard, endeavoring to ascertain the best type of compensator and the proper type of receiving and amplifying gear. Also whether the oscillating or non-oscillating detector shall be used. There will be a number of new pieces of apparatus used and it is expected that the results will have a tendency to standardize Radio Compass installations incorporating some of the latest refinements recently discovered in the art. It is expected that the Bureau of Steam Engineering will soon issue instructions regarding Radio Compass installations which will include the findings of these experiments.

Loop Aerials for Submarines.—According to a paper recently read before the American Physical Society, the submarine loop aerial as finally perfected consists of two insulated wires earthed at the extreme ends of the hull of the submarine, carried over suitable supports to the bridge and thence through radio lead-ins to the receiving and transmitting apparatus. Experiments have shown that communication at sea can be carried on under all conditions more efficiently with such a loop than with the ordinary antenna. The maximum depth of submergence at which signals can be received is determined by the wave length. For short wave lengths the top of the loop must be near the surface of the water, whereas a wave length of 10,000 meters can be received when the top of the loop is submerged 21 feet. Signals can be transmitted from the loop, using a 952-meter wave length, to a distance of 10 or 12 miles when the top of the loop is practically at the surface. The range decreases to 2 or 3 miles when the top of the loop is 8 or 9 feet below the surface. The loop can also be used as a direction finder, maximum signals being received when the submarine is pointing toward the transmitting station.

Carbon Arcs for Searchlights.—A long arc, for any given carbon, whether impregnated or not, implies a high potential, and a short arc a low potential. In order to obtain a given amount of light from a given positive carbon, it is only necessary to pass through it a given current, the voltage, the arc and the arc length required to avoid hissing being immaterial. In order to ensure, however, that all but a very small proportion of light directed towards the mirror from the positive carbon misses the negative, it is necessary for the arc length to exceed a certain minimum figure, and to obtain carbons which will take the maximum current through the positive crater at this minimum arc length, thus securing all the light possible with the minimum amount of dissipation of heat at the arc. According to recent experiments, there is no sensible difference in average candle-power or in crater brightness for carbons of the same diameter run at the same current. The efficiency in candles per ampere, however, increases somewhat for the same current density as the diameter of the positive carbon is increased; it is reasonable to attribute this, at least in part, to the greater relative cooling surface of the smaller carbons.

Science

The Meteorological Magazine.—One consequence of the recent absorption by the British Meteorological Office of the previously unofficial British Rainfall Organization is that *Symon's Meteorological Magazine*, the organ of the rainfall observers, has been combined with the Meteorological Office *Circular*. The united publications will hereafter be known as the *Meteorological Magazine*. "*Symons's*" has been published continuously since 1866, and has just completed its fifty-fourth volume.

An Auroral Display of unusual brilliancy for these temperate latitudes was witnessed throughout a good part of continental United States on Monday night, March 22nd. The illumination began shortly after sunset, and lasted until long after midnight; it was so bright that even against the white lights of Broadway it made a conspicuous figure, while in the suburbs the only word for it was "brilliant." At a time of night after the setting of the thin crescent moon, it was possible in suburban New Jersey to read the smallest newspaper headlines by the unaided auroral light, and to distinguish plainly trees, fences, etc., at a distance of several hundreds of yards. For most of its duration the aurora took the form of streamers in all directions from a single center, which in New York was located a bit south of the zenith. The usual interruption of telephone and telegraph service was noted.

Cloud Formation in the Wake of Airplane.—The formation of a ribbon of cloud in the wake of an airplane has been reported several times lately; *e. g.*, in the SCIENTIFIC AMERICAN of June 7 and August 2, 1919. A striking phenomenon of this character is described in *Die Naturwissenschaften* as having been observed over Munich on May 11, 1919. An airplane flying at a height of more than 5 miles left behind it a long narrow streak of cloud, which persisted for more than an hour and attained a length of more than 30 miles. The cloud gradually broadened, and was marked by waves or knots at intervals. Spectators compared its shape to that of the skeleton of a snake, with vertebræ regularly spaced along it. At one time this cloud drifted over the sun, and a fragment of the 22-degree halo appeared, indicating that the cloud was composed of ice particles (as would be expected at that altitude).

State Awards for Medical Discoveries.—A joint committee of the British Medical Association and the British Science Guild, has just rendered a report urging the British Government to give substantial recognition hereafter to those who benefit humanity by making important discoveries in medicine and surgery. The report points out that "Parliament grants large subsidies to soldiers and sailors, has appointed a commission to consider awards to inventors, and allows patents. It should not, therefore, complain if the medical profession, which has done so much for the nation during the war, now asks for similar consideration." A notable precedent is cited in the action taken by Parliament in 1802 and 1807, when grants of £10,000 and £20,000 were made to Edward Jenner as compensation for his expenses and loss of practice during his historic investigation of vaccination against smallpox.

"Deer-fly Fever."—Under the name of "deer-fly fever," or "Pahvant Valley plague," Dr. Edward Francis, of the U. S. Public Health Service, describes in *Public Health Reports* a disease which has occurred in recent years among the rural population of Millard County, Utah, and which is popularly ascribed to the bite of a fly. It is manifested by the enlargement of the lymph glands which drain the bitten area and by a fever of a septic type, lasting from three to six weeks. The site of the bite and the affected lymph glands become tender and inflamed, and they commonly suppurate. There is marked prostration, and the patient is confined to his bed. One case has terminated fatally. Dr. Francis visited the scene of the outbreak last July and made laboratory investigations, from which it appears that the disease is probably identical with the new plague-like disease found in the ground squirrels of California in 1911 by Dr. G. W. McCoy, the bacillus of which has been named *Bacterium tularense*.

Aeronautical

World's Largest Airship.—The German Zeppelin L-72, largest ship of the air ever constructed, has a tip to tip length of more than 900 feet. It was built during the war expressly to bombard New York. Advice from Berlin states that Americans, French and British have all entered claims for it as a war trophy.

Airplane Engine Muffler.—After extended tests, it is stated that the French Air Service has approved the Schneebeli muffler for aircraft engines, which is said to silence completely the noise of the engine and to prevent any flame from reaching the open air. The device consists of a long tube, sealed at the end, and serves as a continuation of the exhaust manifold. Around its circumference there is a series of longitudinal fins of triangular section. Communication is made from the interior of the tube to these fins by a series of holes about ⅛ inch in diameter. Along the face of the fins are cut a very large number of louvres through which the exhaust gases reach the open air.

National Guard Air Units.—Authority to organize an aerial unit in each National Guard division has been granted by the War Department, according to the U. S. Air Service. Owing to the limited number of experienced regular officers now available as instructors, however, only such units as can be trained with existing facilities will be formed. Each unit will include an observation squadron, balloon company, photo section and intelligence branch. It is contemplated, the War Department announces, that similar units will be included in regular Army divisions under new tables of organizations to be prepared after enactment of Army reorganization legislation.

Trans-Continental Passenger Airplane Line.—Alfred W. Lawson, a pioneer in American aviation and the designer of the splendid Lawson liner which has made an excellent showing in several exhibition flights, has set July 1st next as the date for starting the operation of a New York-San Francisco passenger airplane line. The first airplane is scheduled to leave New York at 1 A. M., Mr. Lawson states, with accommodations, including sleeping berths, for twenty-six passengers. The schedule calls for a thirty-six hour trip with stops at Syracuse, Buffalo, Cleveland, Toledo, Chicago, Des Moines, Omaha, Cheyenne, Salt Lake City, and Reno. The airplane body to be used is 50 feet long and 6 feet wide and the ceilings are 8 feet high.

Speeds at High Altitude.—According to the experimental data in the possession of the technical sections of the Air Service it has been found that at a height of 20,000 feet an engine gives only 45 per cent of the power for which it is good at sea level. The great value of the surcharger now being used with some engines lies in its ability to make a motor yield the same power at 20,000 feet that it does in flying at the lowest altitudes. Whereas the Lepere biplane recently used by Major R. W. Schroeder in an altitude record flight of 31,800 feet, with one passenger, is capable of a speed of 136-137 miles per hour at sea level, at 25,000 feet, where most of the air fighting is expected to take place in the next war, the machine, equipped with the surcharger, has shown a speed of 134 miles.

Air Transportation in England.—Since last September commercial airplanes in England have carried 4,201 passengers and 50,000 pounds of freight, a total of 84,428 miles without injury to a person or a single loss of goods, according to Handley Page one of the leading aircraft constructors of Great Britain and of the world. The passenger traffic between London and Paris, according to this great authority, is $60 per passenger, while a charge of 50 cents per pound is made for freight. "The influence of air transport is going to be enormous in the world's development, especially in the United States, where there are such great distances," states Mr. Page. "Distances are measured generally by the time it takes to go from one point to another. The distance of 1,000 miles between New York and Chicago makes no impression on a business man; he knows only about the 20 hours by train. By airplane the two cities would be seven or eight hours apart, which would thus move the Western City in point of time to the position of Syracuse by rail."

What Arizona's desert will produce under proper irrigation

Flourishing orange orchards where sand and cactus once ruled

Making Farms Out of Deserts

Why We Must Resort to Irrigation, and How We Are Doing So

By Robert G. Skerrett

A LITTLE less than eighteen years ago, Congress, in its wisdom, saw fit to pass the Reclamation Act which has since inspired and brought to an impressive pass an amazing change in the productive capacity of great areas of previously arid or well-nigh arid lands within our continental boundaries. The nation at large is not yet awake to the economic and the vitalizing significance of the undertakings that have been put through by the U. S. Reclamation Service, nor aware of the potentialities of projects under development or about to be taken in hand. The things already achieved are heartening, indeed, for they make it plain that far-flung regions which are little better than barren wastes can, through the agency of water of man's commanding, be transformed into fields of fruitful wealth.

At the close of the last fiscal year the Service was in a position to deliver water to about 1,600,000 acres of irrigable land, and 1,120,000 were actually subject to irrigation. In addition to this, storage water, delivered from permanent reservoirs, was being furnished under special contracts to something like 950,000 acres. The program for the projects already essayed contemplates supplying water for an area of 3,200,000 acres in the aggregate. One does not have to be a farmer to grasp the fact that through this splendid Government agency the nation's food supply is being augmented to a notable extent and financial returns are being won that richly compensate for the engineering outlays involved.

During the span covered by the two preceding fiscal years, a considerable part of the arid region has suffered severely because of aggravating drought. That condition entailed heavy losses to those farmers who attempted to cultivate the soil without irrigation, and there was even a shortage of water in many of the sections where irrigation independently of Government assistance is practiced. On the other hand, the Federal reclamation projects have generally been remarkably free from the consequences of meteorological vagaries. Despite drought conditions they have enjoyed, with the exception of a single small project in northern Washington, a plenty of water—thanks to the ample storage provisions made available by the Reclamation Service. No wonder, then, that there is a greatly stimulated demand for the extension and the completion of existing projects and entering upon others.

The uninformed will reasonably query: "Why should we engage in efforts to turn arid lands into farms when there are vast tracts, lying in seemingly more favored parts of the country, where cultivation is a relatively simple matter and calls for no engineering works of a more or less pretentious and costly character? As

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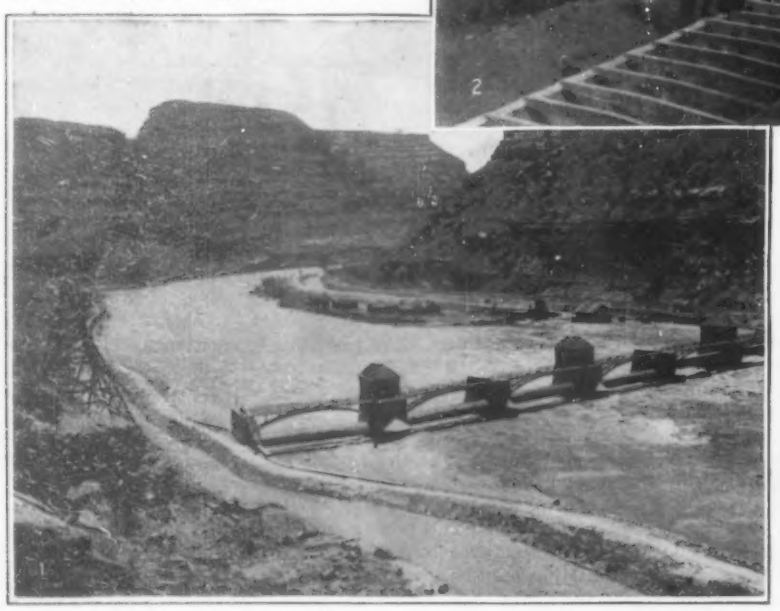


Above: Highline canal on the Yakima project in Washington. *Left:* Roller-crest diversion dam on the Grand River, Colorado; the crest is raised and lowered as the seasons change. *Right:* One of the most prosperous of Arizona's irrigated tracts.

Bringing water to land that needs nothing else to make it rank with the world's garden spots

Gasoline from Natural Gas

By Harry Botsford

THE recovery of gasoline from natural gas was discovered by accident occasioned by natural causes. It was in the year 1873 that natural gas was first piped and used for general heating and lighting purposes. The gas was sometimes run through a small pipe, usually of about one inch diameter, for a distance of several miles.

With the beginning of cold weather much trouble was experienced with the pipe line's clogging up with what was supposed to be water that had been introduced into the pipe in some unknown manner, and freezing. With a view of eliminating this difficulty, the pioneer oil men caused short sections of pipe to be inserted in their gas line, in the low places to catch this supposed water. Imagine their surprise, when one of the drip or waste pipes froze up and was thawed over a fire, to see the ice from the pipe begin to burn furiously! The water theory was discarded immediately.

In the above year a similar condition or rather a near-similar condition was discovered upon the oil lease of Milton Stewart near the Pennsylvania oil town of Petroleum Center. A pressure pump had been put on the oil sands of the oil wells with the idea of increasing the flow of oil. Besides increasing the flow of oil, this also resulted in an increased gas flow. This gas was used to create steam in a 20-horse-power stationary boiler and it was found necessary to put in a drip pipe to draw off the gasoline. About one-half pint of gasoline was made here daily and this drip product was used by the employees to wash their hands with as it was found to cut off the oil and grease accumulated in their work around the oil wells.

This drip product was recognized as being the same as that of the refiners. At this time the product of refiners known as gasoline had but a very limited market as this was prior to the event of the internal combustion engine using gasoline as power.

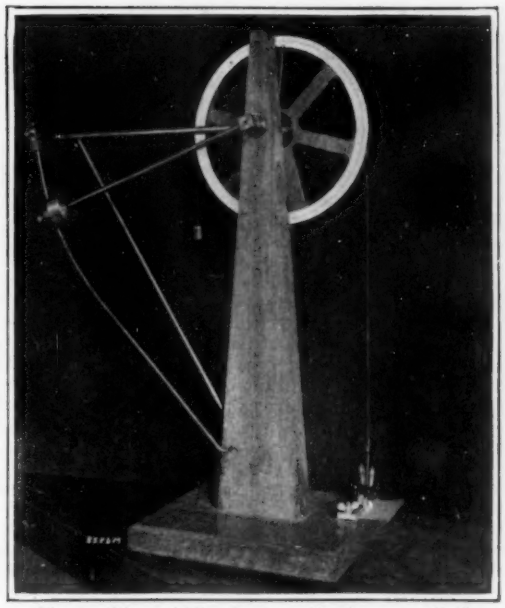
Gasoline from the refineries was sold at an extremely low price as the only demand for it was from oil producers who used a large quantity of it to pour in their oil wells. It was found that several barrels of gasoline, placed in an old oil well in such a manner as to flood the oil-producing sand, would act as a cleaning agent as it would dissolve the clogging gypsum and paraffine that hindered the free flow of oil in the producing sands.

Some refiners attempted to get rid of gasoline, which was practically a non-commercial by-product, by blending it with kerosene oil. This blend, while giving a clear and white light, proved to be very dangerous and many explosions and fires were caused by its use. In fact, so many serious accidents and fires were traced to this one source that legislation in many states forbade the sale and use of such a blend.

In the meantime, no efforts had been made to make gasoline from casing-head gas; but by 1900 the fluid began to show possibilities and commercially the proposition proved worthy of earnest investigation. It was in this year that various oil men make the claim of building and operating the first plant for the manufacture of gasoline from natural gas. After the inception and operation of the first plants and with the growing commercial possibilities of the new product, oil men began to take an active interest in the matter and the process began to go through a course of constructive evolution.

Casing head gasoline, which tests 80-90 degrees Baumé, is exceedingly volatile. The writer has taken a gallon can of this fluid, on a warm summer day, and holding it waist high, poured it out slowly. The evaporation was so rapid that not a drop reached the ground. The original gas pumps, which gave on the average, a pressure of 50 pounds to the square inch, gave way to the high pressure gas engines which exerted a pressure on the oil and gas sands of 500 pounds to the inch. This pressure was found by experiment to be too high and a constant pressure of 250 used with good results.

The first collecting tanks for the distillate were open to the air, which allowed the gasoline to bleach and partially evaporate and thus reduced the volatile properties but resulted in a consequent reduction of volume. This process was used for some time and was known as weathering, but proved to be too wasteful for practical use.

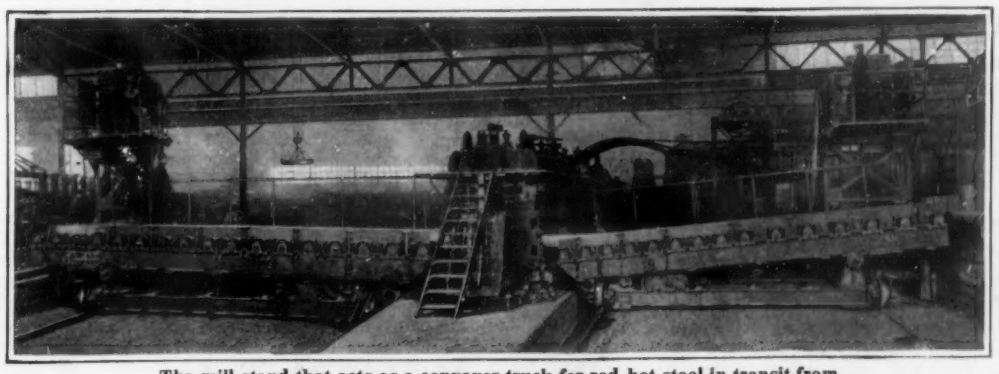


The machine which measures the force required to tear paper

The invention of F. P. Peterson marks the zenith of practicability in the gasoline industry as related to casing-head gas. This process, now in general use, embraces the use of a two-stage compressor method which exerts a constant pressure not only upon the oil and gas-sands of the oil well, but upon the gas while undergoing condensation and cooling. The pro-

(Continued on page 374)

Electric demonstration board for classroom and lecture hall



The mill stand that acts as a conveyor truck for red-hot steel in transit from one set of rolls to another

Testing Paper by Tearing

By S. R. Winters

ATTEMPTS have been made for a long time to develop a machine which would actually measure the tearing strength of paper. The desirability of such a machine is well recognized in the trade but the development of a satisfactory machine has been hindered by various mechanical difficulties. In the first place, it is practically impossible to get a piece of paper to tear in a straight line, and in the second place it is difficult to devise a simple mechanism which will determine the average tearing resistance; this varies considerably even in a very short length. Further, the initial resistance is considerably greater than the resistance after the tearing has once become started.

The present machine overcomes, in a large measure, all of these difficulties and gives promise of practical commercial application. Instead of tearing a single sheet of paper this machine tears three or four sheets at once and furthermore, makes a duplicate tear in each sheet. This eliminates, to a large extent, the troubles incident to the variability of the individual sheets and gives a better average tearing value. The samples of paper to be tested are about five inches square and two parallel cuts, about 1½ inches deep and about 2½ inches apart, are made on one edge. The resulting center tongue is then turned up at right angles and the paper is clamped to the base of the machine with the tongue projecting vertically along the side of the flat metal clamp. The tongue is then gripped by means of a letter clip, from which a wire runs up over the wheel. The counter weight on the other end of the wire balances the weight of the clip. The wheel, which is graduated in degrees, is mounted upon a ball-bearing bicycle wheel hub and a lever is connected to the near side of the shaft. This lever,

(Continued on page 375)

The Electrified Blackboard for the Technical Classroom

TO simplify and visualize the teaching of electrical subjects in our schools a Milwaukee manufacturer has developed what is virtually an electrified blackboard. The device is made up of a strongly constructed rack of cast iron holding one or more units of display racks.

Each display rack or board contains various devices used in electrical wiring and power plant practices. The entire rack is mounted on rolling casters and may be used in any room where classes are to be held and where the proper terminals are located for electrical experimenting. The rack may be used for the lectures of the instructor and as it has shelves on both sides, may be used for experimental purposes by eight pupils. A low voltage of current is made use of in experimental work and the danger of shocks and accidents is eliminated.

In acquiring one of these display racks a school may add to its supply of unit boards in order to keep up with the increased demands for technical education at a small cost and because of the portability of the outfit it may be readily moved from one building to another as well as from one class room to other rooms. The equipment on the boards covers practically every phase of elementary electrical subjects that is taught in high schools, elementary, vocational or continuation schools.—By *Allen P. Child.*

The Mill Stand and Its Work

IT would not be possible to conduct some of the large steel making processes if developments in mechanical construction had not been expansive. The illustration is typical of this statement. It represents what is called a "mill stand" in one of the large American steel plants. It is purely a mechanical and electrical machine to render possible the expeditious and efficient handling of large and heavy red-hot masses of steel from one point to another at the same time effecting a change in the shape and size of the hot steel.

In the center of the picture there are visible some roll stands or mills in which are heavy revolving rolls operated by the large flywheel engine in the background. At either side of these large mills are two platforms, operated by electricity by the men located in the towers, one at one

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Exploiting the Inventor—I

How the Unscrupulous Patent Attorney Works Upon the Purse of His Client

By C. H. Claudy

IF inventors were a class of people, as for instance, shoe-makers are a class, or book-keepers are a class, or railway engineers are a class, the solidarity of their ranks would be easy to effect their education in matters pertaining to their specialty would be a simple matter and their complete protection from sharpers and shady business practices would inevitably follow.

But inventors are not a class. American inventors are of all classes. Millionaire and canal boatman, professor in a university and street cleaner, banker and office boy, mill-hand and corporation lawyer, farmer and laborer—every one is potentially an inventor; and a very large number of men and women (and sometimes children) in all walks of life, sometimes turn their thoughts to the creation of something new to meet a need.

Professional inventors, men who make their entire living by invention and experiment, are a very small proportion of the whole number of people who keep the Patent Office busy. And these men have been trained in the schools of hard experience, have learned the wisdom of selecting a patent attorney with care, and know, fully, their rights. It is not for these that this paper is written, but for the man in the street, the average man, who conceives a new invention, has it patented and is then fair game for any and all who live and grow fat off the ignorance and credulity of those who do not know how the invention may be exploited.

The game begins before the patent is ever applied for. And it began thus early because there is such an abysmal ignorance in the minds of so many as to what a patent really is. Many people think a patent is a guarantee on the part of the government that its owner will be protected in the use of his device or idea. Leaving out of consideration the question as to whether or not governmentally initiated prosecutions of patent infringement would be a good thing or not, it can be stated that a patent does no such thing. It forms rather the basis on which the *owner* may sue any infringer, and is a documentary evidence of the opinion of the government that the owner is the originator of the invention.

A man owns a Liberty bond. He registers it. It is stolen. The registry proves his ownership. But it did not prevent it being stolen. If the police catch the thief the bond is returned to the owner.

A man owns a patent. The patent is a record—a registry. It is infringed. The patent does not prevent some one from infringing it, but if the courts decide on the suit of the owner, that it *is* infringed, it will make the infringer return the profits of the infringement to the owner.

But in the case of the bond, the police pursue the thief on notification. In the case of the patent, the owner must pursue the infringer through the courts.

This lack of understanding is responsible for many patent applications on the part of the people who thus hope to make the government their private policeman. And unscrupulous patent attorneys trade on the phrase "complete protection" to get many clients who otherwise might not employ them. An invention is "completely protected" with a valid and well drawn patent, in the sense that it affords a record of ownership and a title which courts will respect.

A patent is of value only if it really covers something of value. A patent in itself may be absolutely valueless. For a better understanding of this, consider a copyright, which is the corresponding "protection" given by the government to an author. It is perfectly possible to write a book by copying every other word in the encyclopedia. The result would be nonsense. It would have no value. Yet a "copyright" could be obtained upon it. The copyright would have no value because the thing copyrighted had no value.

So with a patent. A patent is valueless if the thing patented is valueless. Or a patent is valueless if it does not adequately "cover" the thing patented. Yet many a struggling inventor has thought of a patent as worth something in itself, the securing of which gave him a valuable piece of property. Naturally, near-honest patent attorneys have traded on this idea and advertised largely to get people to take out patents. One specious argument has been "No patent, no pay." This has done a great deal of harm, but advertising to that effect has been stopped by the Commissioner of Patents.

To understand the insidiousness of this, it is necessary to know a little of what the patent attorney has to do. The Patent Office requires certain things before it will entertain an application for a patent. The idea must be illustrated by a certain kind of drawing, made in a certain way. It must be so described by reference to letters and numbers that the patent examiner can understand it. The "claims" of the actual thing to be patented must be so drawn that each is clear, each different from the other, and so that none conflict with any of the millions of claims already in existence in patents.

There must be a full and complete disclosure of the invention. The attorney is often confronted by a client who either from timidity or dishonesty believes that he can hoodwink the attorney and the Patent Office by concealing some important step in the carrying out of his invention. He not only deceives himself and thwarts his own aims, but receives for his pains a document that is not worth the paper it is written on. The very word "patent" indicates that there must be a full and complete disclosure of the invention. The disclosure must be so complete that any one at all familiar with the art can perform the various steps of the process from the description given in the specification. If the specification fails in this respect the document is untrustworthy and the inventor has received for his pains an instrument which will not hold good in the event that through the success of the invention it is brought before the courts. Let the inventor first satisfy himself that he has secured the services of a competent attorney and then let him repose every confidence in the attorney by disclosing to him fully all that he himself knows about the invention.

No competent attorney can have drawings made, write a comprehensive, painstaking, plain, simple, accurate and complete description of an invention, embody its salient features in a set of carefully drawn claims, and conduct the necessary prosecution before the Patent Office, unless he is paid for his services, and adequately paid. If he offers to "bet" all this work against his judgment that he can get you a patent, it should be obvious to a child that he is going to get *some* sort of a patent or know the reason why. Notice that he doesn't advertise "a *good* patent, or no pay." He merely says "no patent, no pay." Inasmuch as one loosely drawn, vague claim, if allowed, will permit the patent to go to issue, the "no patent, no pay" man can frequently "get by" and take the money from the inventor.

It is not the business of the Patent Office to pass on the value of the invention. If inventors only knew that—but they don't. The Patent Office has no opinion on the value of an invention. All they are concerned with is its novelty, its newness. True, the Patent Office phrase is "certain new and useful improvements," but no patent official dare say what is and what is not useful. Often an inventor himself doesn't know how useful his invention may be; the telephone, the audion bulb, the flying machine, are cases in point.

It has been a common practice to advertise to send lists of "needed inventions." There is no harm in the practice, if it brings no ineffective results. But the harm comes in this way: there are certain inventions which men have tried to make successfully for years. In the attempt, the "art" of that particular invention has grown. A man taking up the "art" for the first time on being told that the invention is needed, will in all probability "invent" something which has been invented half a dozen times before. For instance, the "non-refillable bottle" was prominent on the list of "needed inventions" for years. Now it is perfectly true that in the pre-prohibition days a non-refillable bottle was really a needed device. It is also true that hundreds of them have been patented. The trouble with most of them is the expense, the difficulty of manufacture, or the trouble of use. But the man who goes to work at inventing something as he might go to work hoeing a potato field—the chap who begins with a list of "needed inventions"—will probably reinvent half a dozen already invented and waste time, money and effort in trying to patent something which is either already patented or already rejected as unpatentable.

A small and mean practice indulged in by some wholly dishonest attorneys consists in the calling for a model, and the recommending of a model maker. Now there *are* inventions which really need a model to display to the Patent Office, and there are many cases where a model will help an attorney to form a better and clearer conception of the invention than a sketch. But such cases, compared to the whole number of cases, are few and far between. Yet the dishonest patent attorney, suggesting that a model will help or expedite matters, asks for it, not because it is needed, but because the model maker pays him a commission for getting him business.

There are some firms which make a bid for business by promising to find customers for patents taken out through their office. This, on the face of it, is a fraud. It is predicated on the false idea that the value is in the *patent*, not in the *thing patented*. Moreover it is a distinct and clear fabrication because no one can say in advance that any patent, even of a needed device, can be sold. It depends upon the patent and upon the prospective purchaser and upon a lot of other things.

Another item is the cost of the patent. This is like the cost of any other legal service; you must pay the rate for a good lawyer, or put up with a poor one. It is customary for the attorney to attend to the payment of the Government fees, which come to thirty-five dollars. Since he is not in business for his health, he must charge his client more than this. How much more?—that depends upon the case. He is selling his time and his special knowledge. If he doesn't charge a decent figure for them, the assumption is that they are not worth a decent figure. And—mark this: a cheap patent may cost thousands of dollars in litigation, which could have been saved had the patent been properly drawn in the first place. A valuable invention, poorly protected, represents the most expensive patent that exists—a badly drawn one. If the invention is *really* valuable, the price spent to get a *good* patent is the cheapest insurance for subsequent income from the patent which can possibly be taken out.

The world is full of "easy marks." The hard-headed trader, business man, farmer or workman, who knows his own job like a book, is easy prey for the sharper in the patent field. Yet it is so easy to distinguish. The real patent attorney is a highly skilled specialist, with a reputation behind him, and an ability to do both what he claims to do and to prove that he has done it. He does not gamble with his professional services. He does not prepare drawings, specifications, etc., "free." He doesn't pretend to make a "free

(*Continued on page 375*)

THE American nation is an inventive one, and by the same token the very idea of an invention appeals to us more strongly than to any other people. This means that the man who lives by his wits is always alive to the value which he may be able to get out of a real or an alleged invention. We believe that if the reckoning could be made, it would be found that inventors, investors and the general public have been buncoed out of many millions of dollars through schemes which in some way or other involve an invention or a patent and the general hazy notion that an invention or a patent comprise the easy road to fortune. We have therefore asked Mr. Claudy to look into this matter; and he will present in the SCIENTIFIC AMERICAN *a series of articles showing the various ways in which frauds are perpetrated in the field of patents and inventions. He begins here, right at the beginning, where the man with the invention is seeking to get it patented; and he makes it clear that the only patent attorney who deserves patronage is the one with a record of proven ability and integrity behind him. The present discussion of the ways in which tricky patent attorneys may impose upon their clients will be followed by other articles pointing out other schemes by which the inventor and the general public interested in inventions are deceived and defrauded by dishonest schemes, advertisements, confidence men and shady promoters.*—THE EDITOR.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Some Doubts About the Martians

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of March 6th, under the head, "Who Can Answer This?" you have published a communication in which certain questions are asked as to the best way of communicating with Mars and other planets,and in which the use of an interplanetary sign language is suggested. In a later number you carry a suggestion which I suppose is valid—if we grant all the explicit and implicit assumptions of the authors.

A good deal has been said lately about communicating with Mars. It seems to be a pretty general assumption that Mars must of necessity be inhabited by people like ourselves, and that, Mars being older than the earth, its human inhabitants are consequently much more highly developed and enlightened.

Many believe that the inhabitants of Mars have been trying to communicate with us for many thousands of years, and that they are now eyeing us from their watch-towers expecting some sign.

Now, while it may be possible that Mars is inhabited by some sort of creatures, they could not by any possibility be like ourselves in any essential respect. They are just as likely to resemble straddle-bugs, spiders or ground-moles as they are to resemble us.

Mars is much smaller than the earth; its atmosphere is much lighter; it must have cooled off much more quickly than the earth; the action of the elements upon it must have been vastly different from that of the elements upon the earth, and changes took place upon it with far greater rapidity, so that there was not sufficient time for the slow evolution of various species of animals upon it of such high types as we have upon the earth. Evolution is a very slow process. It is so slow that it keeps pace exactly with the physical changes that take place in a planet itself.

For these reasons alone, it would be utterly impossible for human beings like ourselves to exist on Mars.

But this is not all. It was doubtless by the merest chance that there happened to be any human race upon the earth. Had the snapping jaws of some primordial alligator not happened to miss some old ape-ancestor of ours, the line of evolution might have been broken or its course diverted, and the human race never been developed.

Had a decisive battle between some families of apes ended differently, no human being might ever have been born.

Had it not been for the peculiar kinds and sequence of ice ages upon the earth in recent geologic time, there would have been no human race.

Had it not been for the high, treeless, Asian plateau in a temperate climate, where herds of cattle, horses, sheep and swine could roam and thrive, the arboreal ape never would have climbed down from his tree-home and taken to the plains and developed thumbless feet in the hunt, and finally would never have learned to herd and rear the wild animals, and thus become a shepherd race of human beings.

Again, had there not been that peculiar distribution of seas, lakes and rivers in Europe, the present high intellectual development of the Nordic race is not likely to have occurred.

Had Attila won the battle of Chalons, London and Paris today would probably be mere villages of half-naked savages, whose inhabitants would not be interested in carrying on a conversation with the inhabitants of Mars.

Those who purpose lighting huge signal fires to attract the Martians, or to reach them by wireless messages, if they want to get results to convince the public, should emulate the methods of those who are now telling us of messages received from the spirit-world.

Ghost-land is as likely to be inhabited with beings who want to communicate with us as is Mars. As a matter of fact, the chance of there being inhabitants on Mars like ourselves, or inhabitants with whom we could communicate by signal, is so small that the infinitely little would look like a mammoth beside it.

If one were to take a form of printer's types, set to print the Lord's prayer, throw it into pi, and then throw it back again upon the galley, there would be as much chance of the types falling back into their proper places to print the prayer without an error as there is of there being inhabitants on the planet Mars with whom we might by any possibility communicate.

HUDSON MAXIM.

A Paradox Unravelled

To the Editor of the SCIENTIFIC AMERICAN:

The discussion of gravitation in your issue of January 31st, under title "Why Is It a Pound," leads me to ask for light on a question that has always puzzled me. Your contributor points out that the law of gravity assumes the attraction, and hence the weight, to vary inversely as the square of the distance between the two bodies, which in the case of weight means the distance of the body discussed from the earth's center. But in his drawing he makes it clear that at the earth's center this body would have no weight at all; and I think he makes it equally clear that as we leave the earth's surface behind and advance toward the center, weight decreases. In any event, it is intuitively obvious that this is so; for as we go closer and closer to the earth's center, we leave behind us more and more of the earth's mass, to pull against the ever decreasing portion that we have still in front of us. So weight *must* decrease as we approach the center; yet this contradicts the law of inverse squares. And the greatest weight of any body would be at the earth's surface, in further contradiction of the statement of the law. Won't you explain this apparent paradox for me?

F. H. M.

Boston.

[The contradiction which F. H. M. mentions vanishes when the law of gravitation is stated completely and correctly. The proportionality with the inverse square of the distance, which is ordinarily spoken of as though it were universal, really holds good, and is meant to be stated, only for the case when the two bodies involved are external to one another. It should be more customary than it is to make this clear in stating the law of gravitation.

The fact is, that the law is arrived at by assuming that the gravitational effect of a body is equal to the sum of the effects of its numerous particles; and by further assuming that this effect is the same as though these particles were concentrated into a single particle of their combined mass, and located at their center of gravity. The law of inverse squares is then obvious. But of course the second of these assumptions cannot be made when one of the bodies is inside the other; as F. H. M. recognizes in his intuitional argument, the sum of the effects of the several particles of the containing body is then quite different from the effect of a single particle of their combined mass as their center of gravity. They no longer can be resolved into components in the same direction along the line of centers; if we attempt this, some of these components run in one direction, others in the other, and we have an algebraic sum, not a numerical one.

*For bodies external to one another, gravitation varies inversely as the square of the distance between their centers of gravity. For bodies one of which is suspended within the other, gravitation increases with distance instead of decreasing when distance increases. There is no direct intuitional appeal to establish the true relation; but with the aid of the calculus it is sufficiently easy to show that in this case gravitational force varies directly as the distance between centers. For a complete statement of the law of gravitation we must give both these cases; and when we do so, there is no contradiction between theory and fact.—*THE EDITOR.]

An Appeal to Reason

To the Editor of the SCIENTIFIC AMERICAN:

One of the favorite ways to explain things nowadays seems to be to explain them away. When we ask why a thing is so, we are often told that it isn't so, that we are mistaken in our interpretation of, etc., etc. But to a man who has observed facts that he wants explained, it is not satisfying to be told that these facts "ain't so." He wants an explanation, not a denial.

On this basis I am seeking an explanation of the Ouija board. I want to say right here that I do not believe in spooks, and cannot by any means accept the explanation that the messages which this little contraption writes are the product of departed spirits. But—the little contraption does write messages, and I want to know how and why. It is perfectly preposterous, even if one does believe in the survival of the dead, to suppose that any group of frivolous persons, equipped with eight cents worth of lumber scrap, can get results which are beyond the ability of scientists like Lodge to reproduce. It can't be the eight cents worth of waste lumber that is responsible for these results, and it can't be the character of the participants in the ordinary ouija seance that is responsible for the results. But there is the fact that the most nondescript assemblage, with the eight cents worth of wooden chips, can do something that the biggest scientists can't do without this material. Won't somebody come forward with a rational and convincing explanation of why this is so?

I note that you got pretty rapid action on W. L. B.'s recent demand to know how we were going to set to work to establish an understanding with the inhabitants of extra-terrestrial regions. Won't you give my little puzzlement equal prominence, in the hope of getting equally rapid action on it?

Rational.

New York.

The Watch as a Compass

To the Editor of the SCIENTIFIC AMERICAN:

At request of friends I wish to submit an easier and more accurate method of telling the points of the compass by the watch. The usual way is to point the hour hand at the sun, and one-half the distance between noon and the hour hand would be south. In the first place I let the sun reflect itself on the watch, thereby showing its exact position, not pointing the hour hand, etc. Now to get true north and south, from *noon* to *sunset* I calculate one-half distance from the actual hour and noon and take that as my pointer. For example, say it is 4 o'clock P. M. I let the sun shine on 2 P. M. and that brings the line on the watch running from 12 to 6 on true north and south; 6 is due north, 12 due south.

Now from *sunrise* to *noon* we will reverse things. Say 6 A. M., now we must calculate from that point to noon. One-half of 6 is 3, so I point at 9 o'clock, as that is one-half the distance between 6 and 12 noon. If 8 A. M., then point 10. If 10:30, point 11:15, etc.

The result is *always* true north and south, and you have all the points of the compass by your watch at a glance. It is far better than the usual way, as any one can find out by trying. It is original with me and I have never seen it in print or heard of it, nor has any one else to whom I have explained it.

FREDERICK SKINNER.

Boston, Mass.

Minimum Intensity Giving Optical Sensation

A COMMUNICATION by H. Buisson before the *Société Francaise de Physique* on February 1 referred to the minimum power required for giving optical sensations. A photometric process is described capable of measuring intensities as low as 10^{-8} candle power per square centimeter. The results showed that a luminous source of 1 candle power intensity should still be visible at a distance of 27 kilometers. From this fact it is concluded that the minimum power giving optical sensations is of the order of 10^{-7} ergs per second.

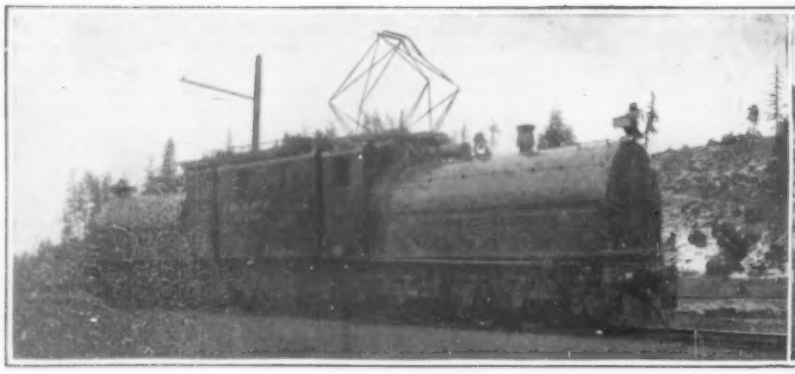
Saving the Holes

THE symbol of thriftness—the capacity of meat-packing establishments to utilize all by-products except the squeal of the pig—finds a counterpart in the economy program of the Bureau of Engineering and Printing is actually saving the holes resulting from perforating postage stamps.

Four barrels brimful of tiny paper disks at the conclusion of each day's operation of the world's largest printing factory are collected from the perforating machines. The redemption of the apparent waste material is effected by the sale of the tiny disks to manufacturing concerns for paper stock. Likewise thread-bare paper money is salvaged by boiling in water and soda-ash in a huge cylindrical tank until the worn-out money is reduced to a wet pulp. Paper manufacturers purchase the material for paper stock.

To revert to the business of saving holes, stamps are printed in sheets of 400 and contain 10,920 perforations. The output of the Bureau of Printing and Engraving daily is 125,000 sheets—approximately 1,365,000,000 holes. This computation takes count of thrift stamps and war savings stamps.

Measured in terms of miles according to a calculation of Director James L. Wilmeth, the daily output of holes perforated from stamps when placed side by side and edge to edge would extend in single file, a distance of 863½ miles.—By *S. R. Winters.*



One of the five 3,000-volt gearless locomotives which will handle passenger traffic on the new road

Type of oil-burning locomotive displaced by the electric operation of the C. M. & St. P. Railway

The old and the new in efficient American railroading, or a practical case of electricity vs. steam

The Electric Railroad Over the Rockies

Completion of an Additional Link in the St. Paul's Ambitious Project

By B. S. Beach

WITH the opening on March 6 of the coast division of the Chicago, Milwaukee and St. Paul Railway between Othello, Wash., and Seattle, what is generally acknowledged to be one of the greatest electrical engineering tasks in American railroad annals was brought to a conclusion after five years of constant planning and at an expenditure of nearly $20,000,000.

The United States thus becomes the unquestioned possessor of the longest electrified railroad in the world—almost 700 miles of main line trackage, or the distance between New York and Cleveland, Ohio. To this must be added about 200 miles of extra track bringing the total mileage up to about 900 miles, or nearly the distance from New York to Chicago.

With the exception of about 200 miles still to be electrified between Avery, Ida., and Othello, the complete electrification now extends from Harlowton, Mont., to the Pacific coast, crossing on its way two mighty mountain ranges, the Rockies and the Cascades.

The electrification of the first division began back in 1914. This section was placed in operation in December of the following year, covering a distance of 440 miles across the Great Divide and the Rocky Mountains. The success of this undertaking was so pleasing to the officials of the road that in 1917 it was decided to electrify the coast division now known as the Othello-Tacoma-Seattle electric zone.

This vast electric transportation system in its completed form operates 61 electric locomotives, including passenger, freight and switching locomotives. These locomotives have, in coming, released for service elsewhere no less than 162 steam engines at an annual saving of 300,000 tons of coal and 40,000,000 gallons of oil—for the railroad obtains its motive power wholly from the natural water resources of the surrounding country.

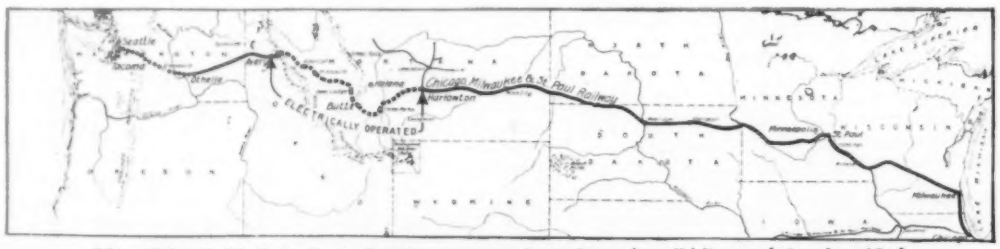
Fifteen hydro-electric power stations make available a combined electric horse-power of 410,000 of which the new division can use 160,000 horse-power. This hydraulically generated current is distributed to the road through eight substations at different points along the line and is in addition supplemented by a 100,000-volt transmission line parallelling the tracks.

Electric rolling stock and equipment for the new division consists primarily of five 3000-volt direct-current locomotives, one of which recently astonished the railroad world by winning a tug of war with two steam engines at the works of the electric company at Erie, Pa. These locomotives, which are the most powerful type of electric passenger locomotives yet developed, are being used in passenger service to haul the "Olympian" and "Columbian," the crack flyers traveling between Chicago and the west coast.

The most interesting feature of the new division is a remarkable 2¼-mile tunnel through the solid rock of a mountain side at Snoqualmie Pass in the heart of the Cascade range. Heavy grades have been unavoidable at many points along the line. In one place a two per cent grade extends over a distance of 20 miles, or a steady upward pull of 105 feet for every mile progressed. Yet the powerful electric takes these grades and others almost as bad at a twenty-mile-an-hour clip, hauling a ten-car passenger train, while on level stretches they make 60 miles an hour.

Traffic on the new road consists of three passenger trains and an average of from five to six freight trains in each direction daily. As illustrating the heights to which the electric locomotives must climb it is interesting to note that the highest point on the road is 6,322 feet above sea level.

The economic features characterizing electric operation on the St. Paul with its new division now opened and the savings effected over the former steam operation are emphasized by the figures. According to these, electric operation has affected a reduction of 22½ per cent in the number of trains, and of 24½ per cent in average time per train; and it has improved operating conditions so that nearly 30 per cent more tonnage can be handled by electric operation in 80 per cent of the time it formerly took to handle the lesser tonnage by steam engine. The capacity of the line has in other words been increased about 50 per cent. This of course is quite aside from the direct economy resulting from the saving of fuel.



Map of the C. M. & St. P. road, with steam sections shown in solid line and the electrified sections in dotted lines

First passenger train hauled by the new gearless electric locomotive, passing through the Cascade range over the Coast Division of the C. M. & St. P.

The Wrecking Derrick and a Concrete Job

By George F. Paul

MODERN methods were employed in making and placing the concrete well for the three centrifugal pumps to handle the condensing water in the generating plant of the Stamford, Conn., gas and electric company on Long Island Sound. Two reinforced-concrete boxes, each 30 by 21 feet in plan and 25 feet high, were first cast on shore. Then a heavy wrecking derrick was pressed into service and the well-structure, which weighs 150 tons, was lowered into place till it rested securely on a foundation that a crew of divers had prepared for it. The well rests in water that is 12 feet deep at low water, but there is a range of tide of 13 feet. The screen chamber is separated from the pump well proper by an interior cross wall 14 inches thick. The walls of each well are 12 inches thick and the bottom 18 inches.

Our Instincts Have Birthdays

DO you jump when you see a mouse? Does your little child also jump? Probably not. But, she will when a certain group of nerve cells that are yet undeveloped reach their maturity. She has undoubtedly inherited your fear of mice and it will sometime appear as an instinct. It is not generally realized that our instincts ripen at a certain age, and that some of them remain through life, and some of them disappear.

The instinct of "feeling" and "self-preservation" remain throughout life; but the instinct to "nurse" disappears when the first teeth come. Other instincts fade out for a time and then reappear, as "mating" and "rearing the young." No child should be encouraged to walk until it manifests a desire to do so, as the instinct for walking appears when that group of nervous tissue has developed. It isn't a matter of muscular development, but of nervous growth. It is a matter of control and not of strength.

At different ages in life certain instincts always appear. The child likes fairy stories, the youth likes adventure; there is an age of song; of friendship, of courtship, of love, of travel, of science, of meditation. They come and go, fresh and active when they are ripe, and seem to us strange and cold before they have arrived or when they have gone.

Structural Steel and Fires

SOME interesting figures relating to the behavior of structural steel at the high temperatures of ordinary fires have been given by the United States Bureau of Standards. Naturally, the strength of steel at high temperatures has a very important bearing upon the stability of a structure which may be subjected to fire. Without any protective covering, steel columns fail after only ten or fifteen minutes of exposure to temperatures such as are reached in ordinary fires. Resistance can be greatly increased by the use of coverings of brick, concrete, plaster, tile, etc., to such an extent that columns so protected are unaffected after several hours' exposure to intense heat.

Tests have been made to determine the compression strength of specimens of structural steel when heated in an electric furnace to temperatures corresponding to dull-red heat (1100 degrees Fahrenheit) and loaded up to 20,000 pounds per square inch. It was found that structural steel loaded to 10,000 pounds per square inch fails at about 1075 degrees Fahrenheit, and under a load of 20,000 pounds per square inch failure occurs at about 925 degrees Fahrenheit. For practical consideration, however, the limit of utility may be regarded as reached at temperatures of about 130 degrees below those given above.

Big derrick lowering the 150- ton pump-well into place in Long Island Sound

Wooden Stoppers as Substitutes for Corks

VARIOUS German papers have recently described practical wooden bottle stoppers which have been placed on the market by a Berlin firm. Certain soft woods are chosen and a special method of shaping renders the wood more elastic, thus enabling the stoppers to adapt themselves to the shape of the bottle neck. The stopper consists of a hollow cylinder, cup-shaped in section, the cavity extending almost to the bottom of the stopper. The solid base of the stopper closes the neck of the bottle and the thin walls of the upper part are elastic enough to adapt themselves to the shape of the neck.

The temporary construction railroad over which material is brought up

Piercing New Zealand's Mountain Barrier

By Oliver Johnson

THE boring of a hole through the Southern Alps of New Zealand for the purpose of connecting the provinces of Canterbury and Westland by rail has been proceeding slowly for a dozen years past. The Southern Alps are a high range of mountains, and the undertaking is the largest of the kind in the Southern Hemisphere.

On August 1, 1907, a contract was let by the Government for the excavation and construction of the Arthur's Pass Tunnel. The time stipulated in the contract for the completion of the whole of the work was five years from August 1, 1907. The contractors procured plans and made preliminary arrangements for power development at the site, which occupied nearly twelve months. They then got to work on the excavation of the tunnel, principally from the Otira end, and in August, 1912, when their contract time expired, had carried the bottom headings into the range for a total distance of two miles 20 chains, leaving a gap between the headings at the Otira and Bealey ends of 3 miles 5 chains. About this time the contractors represented to the Government that their financial resources were exhausted, and that they were unable to carry the work to completion in terms of their contract. After inquiry by a special committee of Parliament, they were relieved of their contract. The work was then taken in hand by the Public Works Department, and has since been carried on under the direct supervision of the Department's Engineers.

The total length of the tunnel is 5 miles 26 chains. The grade is 1 in 33. At the Otira end the tunnel is completed for 2 miles 69 chains, the walls are faced with concrete and the arch is made with concrete blocks. At the Bealey end the tunnel is completed for 1 mile 3 chains. This leaves 1 mile 34 chains to be faced and arched.

The completed portion is fairly dry and drips only occur in occasional places. The uncompleted portion is heavily timbered, this being necessary for the safety of the workers. There is quite a forest of timber inside the tunnel. The rock is much harder at the Bealey end and requires less packing than at the Otira side. At present 130 men are employed and it is estimated that another 100 men could be profitably employed.

The work at the Bealey end is carried out by coöperative contract, two shifts of 8 hours, about 16 men on each shift, not including necessary overseers, etc. The Public Works Department supplies three rooms rent free. Many of the men by a little extra work have made themselves more comfortable. There is an equipped cottage hospital with trained nurse in charge. The Department's motor car is at the service of any one suffering from illness or accident. A well-built school with 60 pupils is within easy reach, with the usual postal and telegraphic facilities. In bad winters the lot of the worker is harder, but this is probably felt more by the men sent up from the cities by the labor bureaus than by the West Coasters employed. Supplies are high-priced. The men have a great difficulty in procuring suitable oilskins for the work, the class of oilcoat usually sold being unsuitable and the necessary strong calico being scarce.

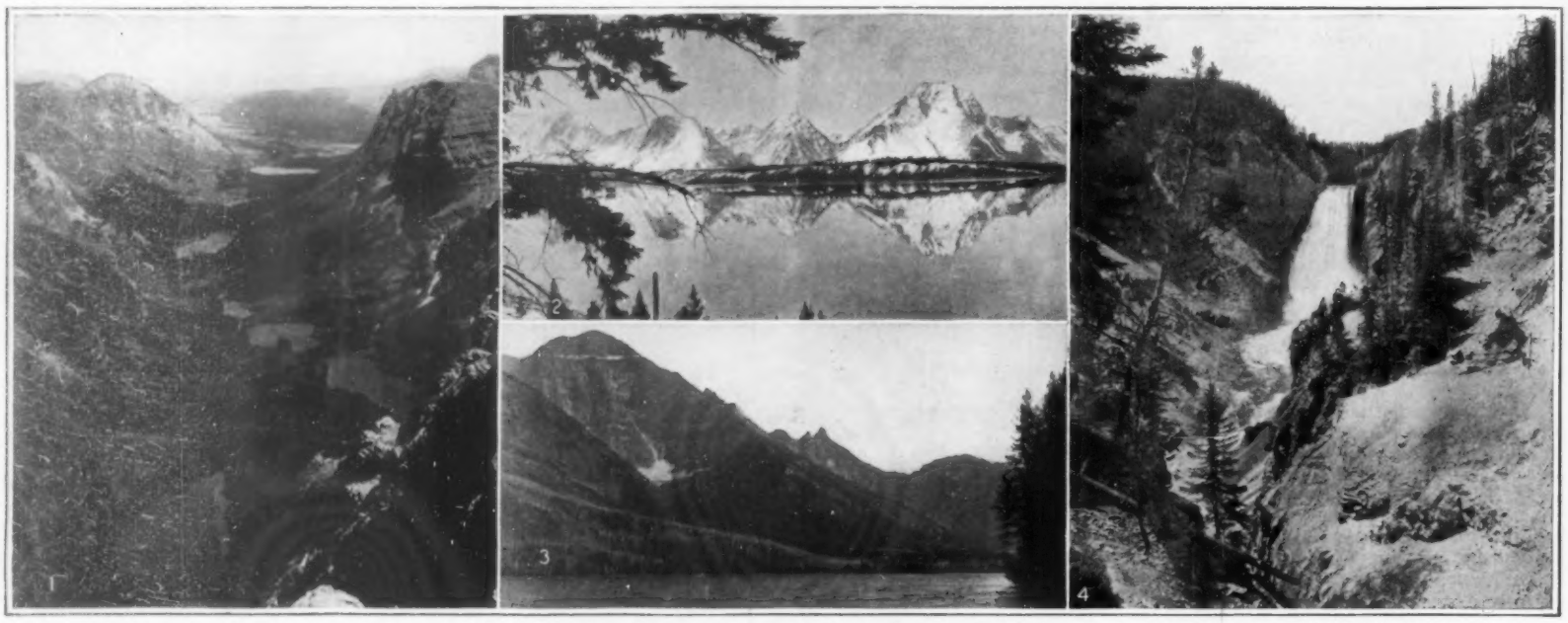
The tunnel is lit with electric lights. There is a manhole every five chains and a large recess every thirty chains. Silicate stalactites are formed where the water oozes through the interstices of the concrete blocks.

Visitors to the engineer's office are shown a most interesting graphical diagram of the progress of the work and the time taken. The Otira end shows regular progress, a little vertical precipice showing where a

(Continued on page 375)

The north portal of New Zealand's big tunnel now under construction

A glimpse out of the southern entrance to the tunnel



Left: Looking toward the plains from Swiftcurrent Peak in Glacier Park (J. E. Haynes). *Center, Upper:* The Teton Range, Wyoming, rises 5,000 to 7,000 feet above Jackson Lake (U. S. Reclamation Service). *Center, Lower:* Mt. Cleveland, 10,438 feet and Waterton Lake in the seldom visited northern section of Glacier Park (Bailey Willis). *Right:* The Great Fall of the Yellowstone (Copyright, J. E. Haynes).

What the camera has to report regarding the natural wonders of Montana and Wyoming

From the Mountains of Montana to the Tetons of Wyoming

Strolls Through a Region Whose Scenic Beauties Are Menaced by the Mailed Fist of Commercialism

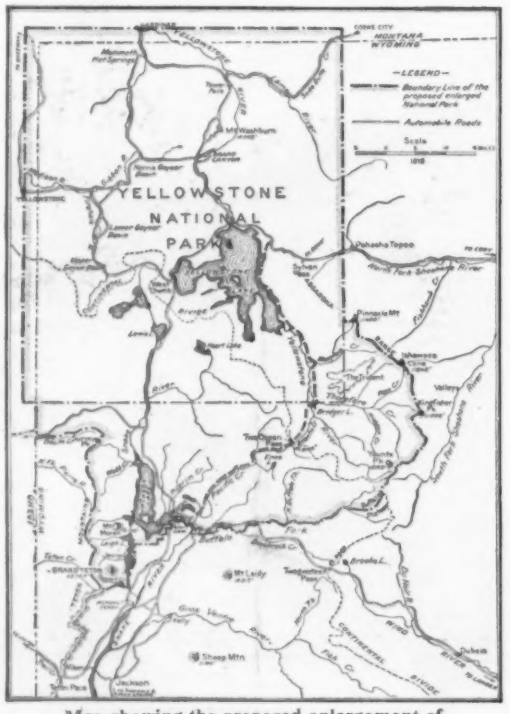
By LeRoy Jeffers, F. R. G. S.

WE entered Glacier Park, Montana, in the usual way, but from Lake McDermott I climbed the wall of Swiftcurrent Pass in search of Alpine flowers and continued upward to the summit of Swiftcurrent Peak where there is a comprehensive view of the park. In ages past internal pressure has forced the very ancient and rarely exposed Algonkian strata to the very summit of these mountains and the landscape is enlivened with buff and gray limestone, green and dark red shale. From the rim of the Grand Canyon of the Colorado in Arizona one may look down for thousands of feet upon these strata, but here their position is reversed. Down the valley toward the plains there is a chain of blue lakes and, in the distant haze, the high ridges glow with soft pink. In other directions there are a multitude of peaks and valleys with many small glaciers. Far to the north is Mt. Cleveland, 10,438 feet, the highest in the park. From Granite Park we visited the Garden Wall, which is the summit of the cirque of Grinnell Glacier. Along the way were colorful strata ranging from light blue-green to purplish red, while here and there touches of bright yellow were added by lichens. As we peered down upon the scarred and dirty surface of the glacier, over which the shadow of serrated peaks was traveling, we heard the roar of the stream on its way to Lakes Grinnell and Josephine. Through the smoke of forest fires the slope of Mt. Allen glowed deep red and purple in the sunlight.

Many enthusiastic writers have overcolored their descriptions of Glacier scenery, conveying the impression that the landscape is like the Grand Canyon. This is not the case, for color is distributed far more sparingly on these mountains and depends to a larger degree for its effect on the character of the light. At evening from the chalet we gazed into the north toward the highest mountains of the park and the distant valley of Waterton Lake which leads into Canada. Twilight had filled the deep valley beneath us; while beyond were two long ridges slumbering in the blue haze. Piercing the horizon was a mountain, gray like the clouds above it. As the sun descended it filled the sky around this peak with deep crimson light, and turned the mountain into a volcano with crater of molten fire. Elsewhere in the light blue sky, golden-tinted clouds became rosy in the afterglow.

Shouldering our packs at dawn, we started on the long trail for Waterton Lake. At first, there was a steep descent of 2500 feet to Mineral Creek, through the towering pine, spruce, larch and fir which clothes the western slope of the range. There were glimpses of rosy peaks, of a blackened hanging glacier, and of little waterfalls on the Livingston Range. Some of the trees were fantastically but fatally draped with hanging moss which sooner or later will cause their death. From the floor of the valley we followed Mineral Creek for miles, beneath the cliffs of Flattop Mountain, to the divide which separates the northern and southern waters of the great central valley of the park. There were carpets of ferns and thickets of huckleberries and red thimbleberries with now and then the thorny leaves and brilliant berries of the Devil's Club. Beyond the falls of Kipp Creek we ascended a high valley where all the trees had been broken off by a great wind. Nestling in every murmuring creek bed was a bower of Alpine flowers, pink and white and yellow, the home of countless happy butterflies and bees.

Climbing the steep slopes of the divide we rounded the walls of Mt. Kipp, admiring the imposing architecture of Cathedral Peak which is most appropriately named. Deer were near at hand, bounding across the mountain meadows as we approached. It was August and the first full glory of the flower fields had passed, but in these high Alpine gardens buttercups and sweet-scented adder tongue were blooming close to the snow-banks. At last we overlooked the course of the Little Kootenay where ridge upon ridge and peak after peak crowded one upon another; then the trail plunged into Waterton Valley with delicious wild raspberries bordering the way. The rocky bed of the creek was deep red and green, strikingly contrasting with the foaming water, and we were impressed with the unusually sharp and curious pinnacles of the Citadel Peaks. After several miles of blood-thirsty mosquitoes whose ability I have not seen equalled this side of Alaska, we decided to spend the night in the shelter of an abandoned cabin. We had traveled over twenty mountain miles that day and were not far from the head of Waterton Lake.



Map showing the proposed enlargement of Yellowstone Park

In the morning we had a rugged view up Olson Creek toward Brown Pass and the famous Bowman and Kintla country. To the left was Porcupine Ridge and towering in the center was the imposing Sentinel. We had thought to visit this region, but the rapidly increasing smoke from forest fires hid the mountains from our view, and, after waiting for some hours on the shore of the lake, we continued for four miles to the Ranger's cabin on the left bank. After a rapid sail of five miles in a canoe we reached the hamlet of Waterton Lakes in Canada. Here is a beautiful view in clear weather of the high mountains which cluster around the head of the lake. It was forty miles by auto to Pincher on the Canadian Pacific, which we reached that night.

The Yellowstone

Scenically the most interesting approach to Yellowstone Park is from Cody by way of the Canyon of the North Fork of the Shoshone. As the gorge narrows its gray walls are tinged with pink and tower abruptly, forcing the road to climb through tunnels. A dam 328 feet in height has been built at the head of the canyon, forming a lake ten miles in length. As we go on through the Shoshone Forest there are many eroded pinnacles of rock, the finest group being named "The Holy City." Through an opening high in the cliffs its towers and spires rise heavenward in impressive and satisfying harmony. After entering the park there is a fine forest of yellow pine, and beyond Sylvan Pass is

(*Continued on page 375*)

The Artist's Bracket Fungus

DURING the winter, when most of the trees are bare, the queer corky or woody growths known as bracket fungi stand out rather conspicuously on diseased trunks, logs, and stumps. The largest and best known of these in our northern woods is the artist's bracket fungus, so called because it is frequently displayed in summer camps with sketches more or less crude etched upon its white under surface.

The upper surface is flat or slightly arched, gray or brown in color, and almost as hard and smooth as horn. When cut or broken open, the layers of growth produced each year may be seen and the age of the bracket determined. The small tubes developed annually on the lower surface contain the spores, which are distributed far and wide by the wind and carry the fungus to other trees.

The artist's bracket fungus growing on a tulip tree, and an immense specimen of this fungus measuring 26 inches across and weighing 40 pounds

These spores are very minute and require a wounded or decayed spot for their germination and early development, but when the delicate branching threads arising from the spores have once become established they permeate the trunk in all directions seeking food and destroying the tissues in order to obtain it.

The development within the trunk may continue several years before the brackets, or fruiting bodies, appear on the outside of the tree. Once within the trunk, however, the fungus cannot possibly be reached and destroyed, although the destruction of the brackets will, of course, lessen the number of spores that are produced and blown to other trees.

But there is little chance of escape for any tree having a wound or decayed spot, since the number of spores produced is so enormous as practically to fill the entire forest with spore-dust day and night from early May to late October. A single bracket of this fungus liberates into the air about 30,000 million spores in 24 hours, and a single trunk may bear from 10 to 60 brackets, all discharging spores at once during the entire growing season and reviving year after year with even greater activity and a larger output of spores. This species probably holds the record among fungi for spore production.—By *W. A. Murrill.*

Nightly Cooling of Lower Strata of the Atmosphere

THE chief cause of the cooling at night of the lower layers of the atmosphere is radiation from the dust particles suspended. To this the formation of temperature inversions near the surface is to be attributed. Most of the heat is radiated into space; the amount radiated to the surface of the earth is about 1/3 of this. The conclusion seems to be well supported. (Albert Defant, *Annalen der Hydrographic und Maritimen Meteorologie*, Part V./VI., 1919.)

The Forefather of the Motion Picture

JUST who is the father of the motion picture is a matter of bitter controversy in which Americans and Europeans are equally keen to enter. But when it comes to contesting the title of forefather of the "movies," the atmosphere is relatively quiet.

So we proceed to nominate the shadow pictures and puppets of ancient Java, recently presented to the United States Museum by the King of Siam, as the forefather of our present-day photoplays. The pictures, in those dark days before the dawn of written history, were thrown on a screen and moved back and forth before the Javanese audience as the exhibitor told the story. The puppets were cut from deer hide, and considerable skill was obviously required to do this work. Some of the more elaborate puppets were animated by strings, as in the case of the one at the left in the illustration.—By *Alfred Mayfield.*

Copyright, Keystone View Co.

Javanese puppets used for animated shadow-pictures

The Traveling Sand Dunes of Peru

AS one makes the ascent of the Andes from the Pacific port of Mollendo, Peru, following the line of the Southern of Peru Railway, the climb to the divide is broken by two great steps or wide-spreading shelves of desert or pampa.

On the first of these steps, about two hours' steep climb from the sea, and at an altitude of from 4,000 to 5,000 feet, are located the famous drifting sand hills of Peru. The plateau is here about twenty miles wide, the air thin and dry and no trace of vegetation to be seen, only these gigantic crescent-shaped sand dunes dotting the pampa as far as the eye can see. Composed of fine gray crystal sand, they gleam white against the brown of the desert, and their horns point toward the prevailing south wind of this region. They are from fifteen to twenty-five or even thirty feet high, twenty feet in breadth across the thick part of the crescent and sometimes one hundred feet from horn to horn. So tightly is the sand packed that the feet of the horses or mules make little impression on it.

These sand hills, called *medaños* (pronounced ma-dañ-yos,—possibly a Latinized form of dunes) travel with almost imperceptible slowness, and when they threaten the railway track they can sometimes be diverted by piling up blocks of stone in their paths. Otherwise the railway bed has to be altered to go around them. An analysis of the soil of this region shows that it would be very fertile if irrigated from the available snow-fields of the Andes, so that it is possible there will come a day when its desolate sand dunes will cease to be.—By *G. E. McDonald.*

Simple Way of Killing a Weed

STRONG growing weeds with elaborate roots are often difficult to kill. Sometimes they cannot be lifted without doing damage to adjoining plants; yet to cut off the surface foliage and leave the roots in the ground is no good at all. After this the weed frequently grows more vigorously than ever.

Any weed may be killed in this way. Cut off the top growth down to the ground. Then scoop out the central stalk as much as possible and fill the little cavity with salt. If possible, do this in dry weather. When rain occurs and the salt dissolves, quickly place a fresh amount on the root. At the end of three days (if the salt has not been washed away) it will have penetrated to every part of the root and the weed will never give any more trouble. Weeds with roots a foot deep have been lifted after this treatment when it has been found that the whole underground system of the plant was brown and rotten right to the tips.—By *S. Leonard Bastin.*

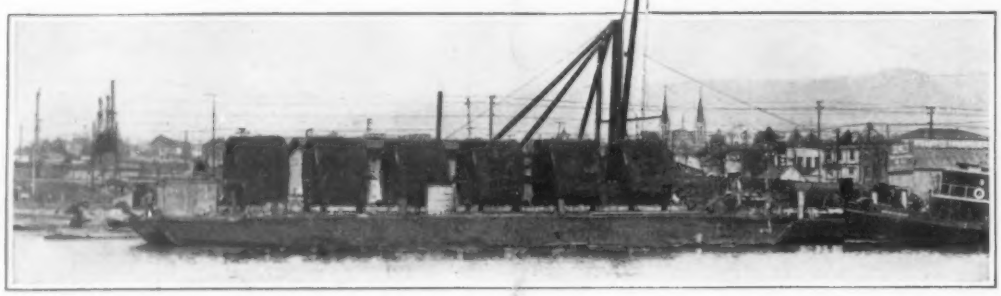
Huge crescent formed by the white sand on the gray of the desert plateau of Peru

Near view of one of these bizarre crescents measuring 25 to 30 feet high and 100 feet wide

From Boneyard to Shipyard

The How and Why of California's New Ship-Building Center at Oakland

By H. A. Crafts



Six 55-ton marine boilers built at Oakland late in 1919. They are here seen loaded on scows for shipment to Los Angeles, where the hulls await them

MUCH publicity has been given to the great new shipyards of the Atlantic coast, especially those in and around New York and Philadelphia. Everybody of course realizes that the vast outbreak of ship-building of the past five years has not been confined to this part of the country; but few, perhaps, realize the extent to which it has been carried in other parts of the country. The Pacific coast, for instance, has been the scene of a comparatively little advertised ship-building development of great magnitude.

The demand for ships—we need not dilate on that. The Atlantic ports were congested with traffic, and with the construction of great numbers of vessels in the bargain. Moreover, the Atlantic seaboard was near the submarine zone—at times actually in that zone—while the Pacific ports were far removed from anything that could disturb operations. So the whole coast began to hum with the busy sounds of human activity; and the shipyards grew up like mushrooms in the night, to become the centers of feverish industry.

In all the line of Pacific Coast shipyards, from Vancouver to San Diego, no one port saw such a remarkable development as did that of Oakland, California. In output of tonnage it has beaten all its competitors, and has crowded the biggest record of some of the Atlantic ship-building ports.

But why Oakland? Here come in such elements as geographical location, transportation, topographical and harbor conditions, etc.

Oakland was situated on the main land, bordering upon the bay of San Francisco, one of the largest and most commodious harbors in the world, having an area of 420 square miles, and a shore line, exclusive of navigable inlets, of 100 miles. Oakland of itself has a water front of 29 miles, and already had docks constructed of more than 9,000,000 square feet in area. It was also the terminus of three transcontinental lines of railroad, the Southern Pacific, Santa Fe and Western Pacific. Oakland is also contiguous to San Francisco, the leading commercial, financial and shipping center of the Pacific Coast. Only seven miles of land-locked water lies between the two cities.

But some might be inclined to ask why all this ship-building activity was not located on the San Francisco water front? There were two principal reasons, one of a geographical and another of a topographical nature.

Be it known that San Francisco is cut off from transcontinental rail communication, save by seven miles of bay ferriage. On the other hand Oakland is the immediate terminus of three transcontinental lines named above, two of which virtually skirt the ship-building section of the city and are thus able to deliver material at the very back doors of the yards, almost without the necessity of shunting and most certainly without the necessity of ferrying.

In the discussion of topographical advantages it becomes pertinent to describe what is known as Oakland's "inner harbor." This is nothing more nor less than a narrow tidal channel, dividing the city of Alameda from that of Oakland. This strip of water varies in width from 300 feet to a quarter of a mile. The wider portion is known as Brooklyn Basin, and is situated about midway of the Channel's length.

The Government has been engaged for years in dredging out Oakland's inner harbor. As the bottom is composed largely of sea sand and silt the matter of dredging is quite simple. The building of a few cheap wooden bulk heads, and then the operation of suction dredges constitutes the bulk of the necessary labor. In this way the channel is made navigable for larger and larger vessels, and at the same time some very valuable shore land is created.

The inner harbor is entered at its western extremity. For 9½ miles it has been dredged to a depth of 30 feet at low water; for 2⅜ miles to a depth of 25 feet; and for 5½ miles to a depth of 18 feet. The Government is still at work, pushing the dredging towards San Leandro Bay into which the harbor merges. In dredging Brooklyn Basin an island was formed in its center with a navigable channel on either side. This is known as Government Island, it being the property of the United States. Here is located the Government shipyard where for the past two years the reinforced concrete vessels whose performances have several times been described in the SCIENTIFIC AMERICAN, have been building.

There are many conditions outside of mere geographical location that go to make up the ideal ship-building yard. Shore formation, marine and climatic considerations, etc., enter largely into the proposition.

San Francisco is built upon a hill or a series of hills; Oakland upon a flat, so far as her water front is concerned. Both shores of her "inner harbor" are mere sand beds that slope gently to the water's edge. These conditions obviate the necessity of excessive excavation; and ships ways may be constructed in many places with hardly turning a shovelfull of earth.

The principal work needed in the permanent construction of ways is to drive a sufficient number of piles to bear up the weight of the works plus the weight of the vessels when their hulls have been completed. Successful pile driving implies the easy reach of bed rock. In the case of Oakland's waterfront, which on the surface looks so much like a bottomless bed of sand, bed-rock is frequently struck at a depth of four feet; seldom do the pile-drivers find it necessary to go more than thirty or forty feet.

Climatic and marine considerations in ship-building demand still winds and still waters; and herein Oakland's waterfront was found to be most desirable. Both as a wind break and as a water break for the inner bay, the San Francisco promontory is a tremendous factor.

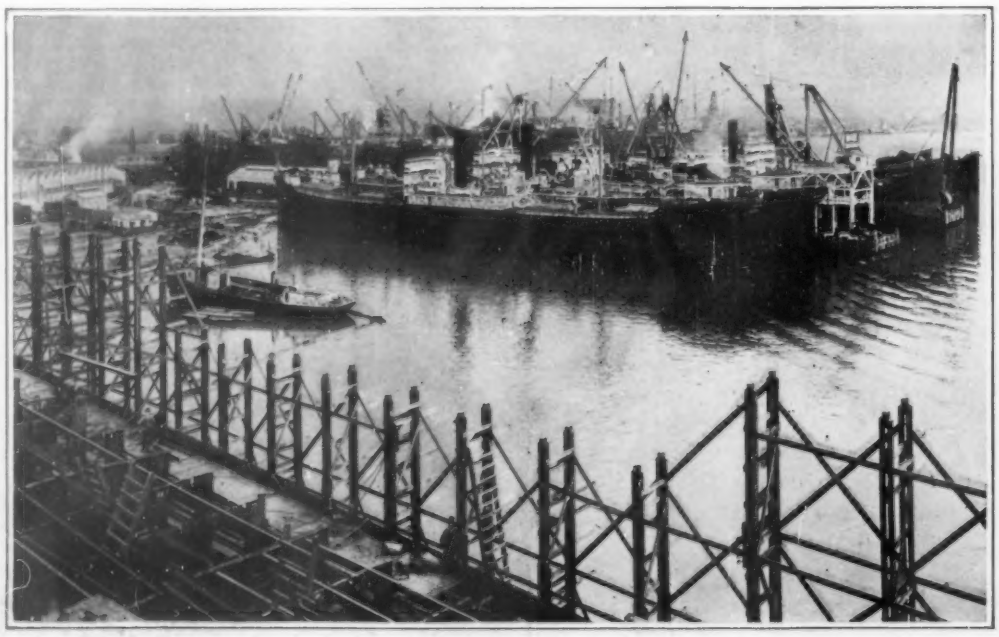
This promontory is but a ridge of hills set just on the edge of the rolling Pacific; and on top of this ridge San Francisco has built a solid assembly of buildings, both large and small, which act as an additional wind break for the bay region. Great gales and heavy tides surge inward through the Golden Gate and sweep around the Barbary Coast with great force, making San Francisco's water-front one of strong winds, powerful tides, and conflicting currents. Her immediate harbor has deep water and precipitous banks. But when these rushing winds and waters once pass through they begin to diffuse themselves, like a great fan; so that by the time they have traversed seven miles of protected bay they have become pretty well spread out, and their force broken.

Approaching Oakland's inner harbor again we find it doubly protected both from the fury of the winds and the waves; and this by means of the island of Alameda which stretches out to the full length of the harbor, and some to spare.

What sea rolls itself across the bay is met by the outer shore of the Alameda Island, and upon this it

(Continued on page 376)

READERS of a series of marine fiction which ran through one of our contemporary weeklies for several years will recall that the great tidal flats along the shore-line, across the bay from San Francisco and above the city of Oakland, were there frequently mentioned as the resting place for ships that had outlived their service. For miles along Oakland's inner harbor, there have always lain long lines of rotting hulks in all stages of deterioration. Indeed, this section of the water front has had the inelegant but expressive name of "The Boneyard." In the present story, Mr. Crafts tells us of a great transformation, by which, as his title suggests, the Boneyard was converted into a hive of industry for the building of ships.—THE EDITOR.



General view of one of the Oakland ship-building plants. The fitting-out yards are in the foreground, and in the background are seen the building ways and the city of Oakland

Left: Modelling the clay original. *Center:* Pouring the wax into the plaster molds. *Right:* Removing the plaster from the wax.

Three views in the shop where wax lay figures are manufactured

Making Wax Dummies for Fashion Displays

DID you ever wonder where the beautiful pink-cheeked "lady" who displays the latest styles in the store window comes from? or whence the equally pulchritudinous male figure over whose manly form are draped the ultimate productions in sartorial elegance? In other words, how are the wax lay-figures made that are employed for display purposes by the manufacturers and sellers of wearing apparel? There is a large business here, if we but visualize the number of establishments that have from one to hundreds of these lay figures, and their manufacture is indeed quite an industry.

Strange and incredible as it may seem when we view some of the results, the features of these models are actually copied from life. They are made in the first place in clay by a regular sculptor, and from this original plaster molds are made in two or more sections, in such a way that they can be withdrawn from the clay model without damaging the latter. In this way one original serves for the production of a large number of the wax figures. The plaster mold-sections are properly joined for the pouring of the wax, and again economy rules when the plaster is removed intact from the cooled casting within, to be used again and again in this ingenious reproducing process.

Curiously enough, the wax mold is not solid; but no core is necessary to bring about this result. Wax is almost indifferently solid and liquid at the temperature of the workroom. After the mold has been poured, it is allowed to stand for 15 or 20 minutes; at the expiration of this time it has solidified for a thickness of about an inch from the surface in contact with the plaster. But the center, beneath this depth, remains still liquid, so the plaster with the wax in it is turned over, and the liquid wax poured back into the kettle, leaving the inch-thick hollow shell in the mold. Obviously this procedure calls for a good deal of care

(Continued on page 378)

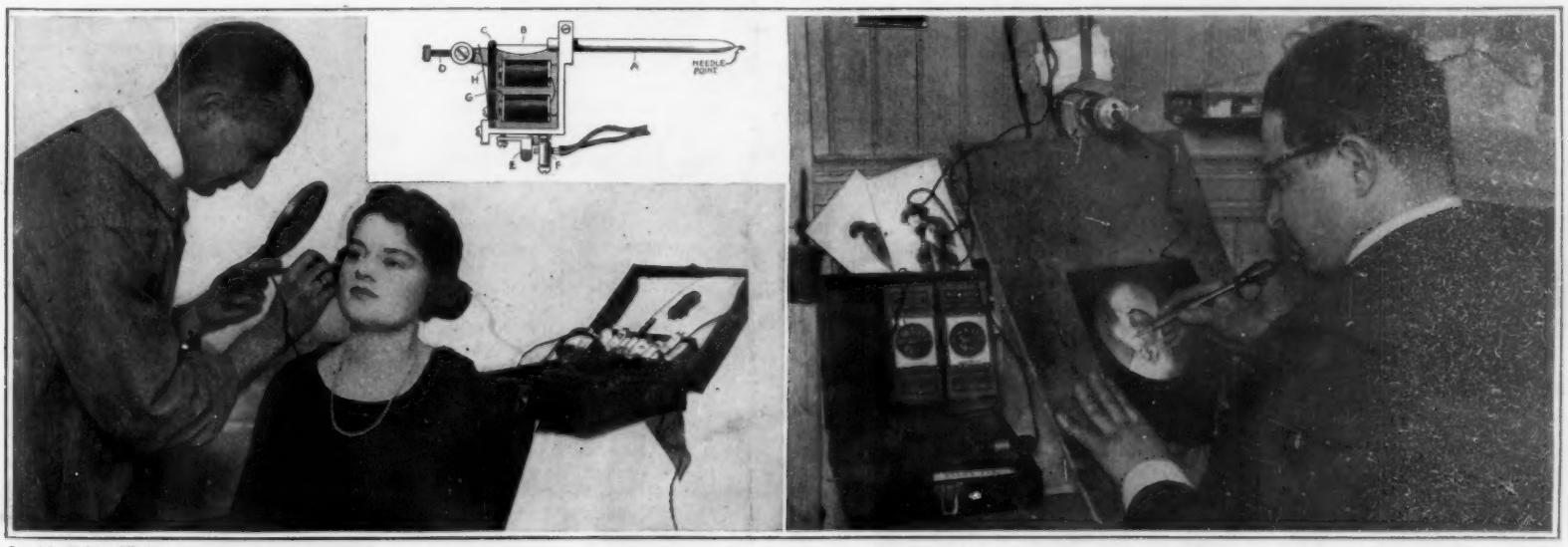
Putting the finishing touches, by hand, on faces and fingers

Some Novel Uses for the Tattooing Needle

USUALLY when we think of the tattooing process, we think of a more or less disreputable establishment on the Bowery or the Barbary Coast, where burly soldiers and hard sailors come to have colorful designs inserted on the few square inches of their epidermis that still display the native hue. But the little needle is today used for other things than the delineation of pink cupids and blue anchors upon manly bosoms and husky forearms. Next time you notice a fair damsel whose complexion remains a beautiful and constant pink despite all temptation to blush or pale, do not attempt to settle the question of artificiality by the mere application of water. Seek rather to learn whether the beauteous lady has not been a patron of the tattooer, who for an appropriate consideration will insert beneath her skin just the right shade of delicate flush—giving a complexion that is not merely permanent and immune to the ravages of accident as well as those of time, but one that is vastly more attractive than rouge laid on with a shovel.

But the ingenious tattooer who seeks a source of income to fill in the moments between the pink cupids and the blue anchors has not shot his bolt when he

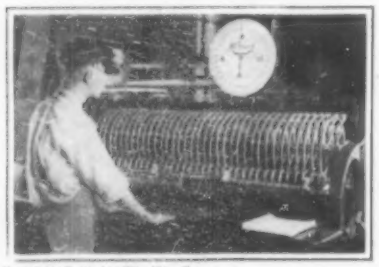
(Continued on page 378)



Using the tattooing needle in the beauty parlor to make a permanent complexion, and in the photographic studio for retouching negatives. The insert shows the construction of the needle and its electric connections

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts



Copyright, Rotlacker Film Mfg. Co.

The wheeled fingers of this machine measure the square-inch surface

Square Inches at a Glance

IMAGINE the task of measuring the square inch surface of the usual hide, with all its irregularities and small ends! A fit job for the able mathematician, you say. But fortunately for those who handle thousands of hides in the course of their daily work, a mechanical square-inch calculator is now available that does the work in the time that it takes to pass the hides through it.

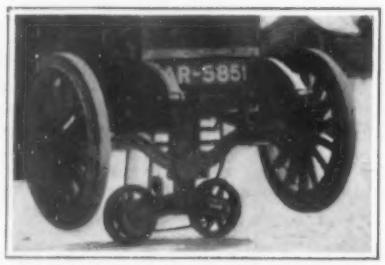
The square-inch calculator, which is shown in the accompanying illustration, comprises an intricate battery of wheels, chain transmissions and a large dial graduated in square inches. The hide to be measured is passed under the battery of wheels. Obviously, where there is hide passing the wheel directly above it turns, whereas the wheel remains stationary when there is no hide beneath it. The elaborate chain transmission system forwards the total turns of all the wheels to the large dial, where a square-inch reading is immediately available. This machine measures hides of all sizes and shapes. Even the small ends, no matter how irregular they may be, are measured.

A Fountain for the Dining Room Table

HERE is the latest thing in table decorations—a rather elaborate decoration to be sure. It is an electric fountain of attractive design and compact dimensions. A little electric motor is directly connected with a small rotary pump that forces the water from the well up into a ring fitted with about twenty small nozzles. The height of the water is regulated by a valve on the supply ring in the basin. The well is of copper and fits within the jardiniere; about one quart of water is used in this fountain's operation. The overflow leads back into the reservoir, so that the same water is used over and over again. In the summer, the addition of a little ice and a small amount of perfume spreads a delightfully cool and refreshing atmosphere about the room. When the nozzles are carefully adjusted, there is no splash beyond the catch basin.

Copyright, Publishers Photo Service

A tiny electric motor drives this ornamental table fountain



These little wheels enable a motor truck to turn in its own length

Making a Truck Turn in Its Own Length

FROM England comes the ingenious device shown in the accompanying illustration. It consists simply of a pair of little wheels held at right angles to the front wheels and driven by a chain drive that is controlled from the driver's seat. The small wheels, it will be noted, can be raised or lowered so as to allow the truck to operate normally or otherwise. When set in operation these small wheels swing the truck about in a circle, using the rear wheels as the pivot. The device has been employed with success in a London railway station, where the congested traffic makes it necessary for motor trucks to be more flexible than usual.

A New Type of Manufactured Fuel

A NEW type of fuel for which remarkable claims are made has been invented by Mr. Richard Bowen, managing director of a company which has recently been formed to exploit the process. The new fuel is produced from coal slack and dust, lignite, peat, or other material, with a binder of pitch. The blocks are formed of a number of layers, which have the same effect as the laminations in ordinary large lumps of coal. The new fuel can be made in blocks of any desired size, and by combining various types of material it is stated that a product of any required calorific value can be produced.

It is claimed that a good house or industrial coal can be produced from materials that could not hitherto be utilized for these purposes. Put briefly, the inventor's claim is that out of what has so far been regarded as waste material reconstructed coal, in layers or laminations, just as it occurs in the earth, has been produced. The cost of laminated coal is said to be considerably below that of ordinary coal. We understand that licenses to work the process have already been acquired by a number of collieries in Great Britain and that negotiations are in progress with many others. French collieries are also adopting the process, and Italian firms are displaying great interest in the matter. The Canadian Government and the government of Victoria are investigating the process with a view to employing it in the utilization of the extensive lignite deposits of Alberta, Saskatchewan, and the State of Victoria.

Light for the Phonograph

THERE has been almost no end to the small lights intended for the illumination of phonograph turntables, for the demand for such a device has been incessant and voluminous.

One of the latest developments along this line appears somewhat simpler and neater than the great majority of those that have preceded it on the market. This device is mounted upon the side of the machine directly opposite the center of the record. On some types of machines there is insufficient room to permit this kind of mounting, in which case it is mounted further forward upon the side, and provided with an angular reflector which directs the light backward in the path of the needle upon the record. Upon flush type machines it is mounted horizontally and equipped with a reflector with an opening in the side. This device so directs the light that the record as well as the needle is fully illuminated. The illumination is either permanent or intermittent as desired by the operator. When used intermittently a slight pressure of the hand as the needle is being placed on the record is all that is required to operate it. A four-volt tungsten battery is used, making the instrument entirely self-contained.

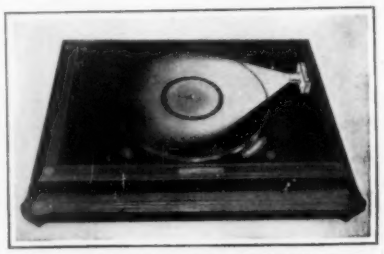
Copyright, Keystone View Co.

A flower pot filled with sand makes an excellent pen holder

New Use for a Pot of Sand

AN inventive young lady has devised the pen and pencil holder depicted in the accompanying illustration. Indeed, the same device serves to hold brushes where the artist is concerned.

In truth—and the self-explanatory nature of the illustration compels briefness, to be sure—the device consists of a flower pot filled with clean sand. The usual hole at the bottom of the flower pot is covered with a heavy disk of paper. Pencils and pens are conveniently held in this novel holder; but it is in holding paint brushes that this device serves to the best advantage. The brushes will remain as placed, no matter if the handle is short or long. They will not roll over and absorb color from the other brushes. Clean and wet brushes may be kept in the same pot.



The small, self-contained electric lamp lights the phonograph

An Industrial Exhibition

TO encourage the introduction of home-made articles and thus help regulate the unfavorable exchange, a permanent institution is now being contemplated in Copenhagen which it is hoped will put Danish manufacturers in direct connection with foreign consumers and will undertake investigations as to the best market for Danish articles of export. This institution will be called the Skandinavisk Industri Udstilling (The Scandinavian Industry Exposition) and will give foreigners as well as the Danish people a chance to see what Denmark is able to produce in an industrial way.

The second Scandinavian annual commercial meeting was held in November and there were present about 20 delegates from each of the three Scandinavian countries. The first meeting of the board was held in 1918 at Stockholm. The purpose of these conferences is, of course, the bringing together of the three northern nations in a closer commercial alliance.

The Lighted Broom for the Dark Corner

ONE must see where the dirt lies in order to sweep it; and so an inventive young man has gone to work and provided the usual broom with a pocket flash light, as shown in the accompanying illustration. It will be noted that in this crude model the flash light is merely held in place by adhesive tape, but in the commercial article the design would be more compact and far neater, to be sure.

Copyright, Keystone View Co.

The flashlight on the broom illuminates dark corners

A TEST of solid vs. pneumatic truck tires was conducted in the winter, spring and summer of last year by a corporation operating a very large motor delivery fleet. Two trucks were used—No. 134, shod with solid tires on the rear wheels, and No. 135, shod with pneumatic tires on the rear wheels. Both were equipped with pneumatics on the front wheels. Nevertheless, the difference in the rear tire equipment was sufficient to produce the following wide difference in results:

	Truck No. 134 (Solid tires rear, pneumatic tires front)	Truck No. 135 (Pneumatic tires on all four wheels)	Difference in favor of All-Pneumatic equipment
Number of days operated	129.5	129.5	
Delivery or pickup stops	4,183	5,822	39% More customers served
Total units (pounds)	874,791	989,065	13% More product hauled
Miles traveled	4,476	6,414	43% More distance covered
Gallons of Gasoline	1,125	1,110	45% Less fuel per mile
Pints of Cylinder Oil	605	494	76% Less cylinder oil per mile
Drivers' and Helpers' Wages	$1,375.15	$1,512.82	23% Less labor cost per mile

The results of this test afford a vivid idea of the reasons why so many businesses throughout the country are replacing the solid tires on their trucks with pneumatics.

Truck owners can obtain the operating and cost data of similar comparisons of pneumatic vs. solid truck tires by writing to The Goodyear Tire & Rubber Company, Akron, Ohio.

GOODYEAR
CORD TIRES

Recently Patented Inventions

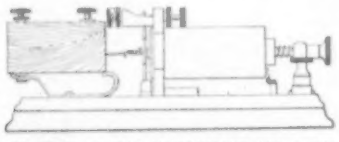
Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Apparel

BELT OR GIRDLE SUPPORT.—M. E. HOPSCHMANN, 945 Delaware Ave., Springfield, Mo. The invention relates generally to ladies' skirts, and particularly to a support for the belt or girdle thereof, the object being the provision of a simple device for eliminating the sagging and protruding of the upper rear edges. The invention provides a supporting attachment, the nature of which permits of its convenient, effective and comfortable use either with or without a corset.

Electrical Devices

TELEGRAPH SOUNDER.—J. W. JACKSON, 510 Grand St., Henryetta, Okla. This invention has for its object to provide a sounder for a telegraph relay which will dispense with the local battery and extra sounder magnets at each station, and enable the ordinary



A SIDE VIEW OF THE INSTRUMENT AND SOUNDER ARM

relay with its relatively feeble power to produce loud and distinct signals without impairing the efficiency and certain action of the armature relay.

REFILLABLE SAFETY INDICATING FUSE.—A. A. WELLS, 42 High St., E., Detroit, Mich. The invention relates to an electric fuse of the knife-blade type and is especially adapted for systems of high amperage. A specific object of the invention is the provision of a fuse having a device which serves as a blown fuse indicator and has an arc interrupter so that when the fuse blows this fact will be immediately indicated and an arc springing from one terminal to the other will be prevented.

STORAGE BATTERY.—P. M. MARKO, 1402 Atlantic Ave., Brooklyn, N. Y. The invention relates particularly to a cover and to level indicating means for the electrolyte. The principal object is to provide a cover which is of transparent material so as to permit the level of the electrolyte to be easily ascertained at any time without removing the filling plug, and also to facilitate the filling of the battery from time to time so that the proper amount of liquid can be supplied without danger of overflow with the attendant evils.

Of Interest to Farmers

AGRICULTURAL IMPLEMENT. — J. S. DALEN, Carbury, N. D. The invention relates more particularly to a device for cutting and gathering weeds. The primary object is to construct a device which, in addition to cutting the weeds, gathering the same in piles in order that they may be burned, thereby saving the time and trouble of raking the cut weeds into piles, as in the ordinary way.

SEED PAN.—S. F. DAWKINS, Fayette, Miss. The object of the invention is to provide a construction of pan adapted to be removably secured to the sickle bar of a mowing machine, and which will effectually guide hay, clover, and the like, over the top of the pan and collect within the pan the seed falling therefrom. A further object is to provide a pan which can be attached to any ordinary mower.

Of General Interest

UMBRELLA ATTACHMENT.—L. B. MCKENZIE, Grand Ave., Leonia, N. J. An object of the invention is to provide a construction which will hold an umbrella in place when placed on a flat surface, but will not injure the surface. Another object is to provide an attachment for an umbrella which may be made permanently on the handle, or attached temporarily, the attachment including a rubber or soft member for engaging the upper surface of a table or other support.

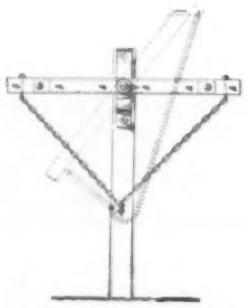
FIBER COMPOSITION.—H. VON UFFEL, 338A, Whitehall Bldg., 17 Battery Place, New York, N. Y. The invention relates to a fiber composition characterized by its fireproof qualities and its adaptability to be worked into various forms at normal temperature. The object is to provide a fiber composition which is made largely of material hitherto discarded as worthless but which is particularly suitable for roofing, and as a substitute for felt when chemically treated. The material referred to is coir, which constitutes the husk formed of fiber and the pithy material of the cocoanut.

MACHINE GUN.—J. F. O'MALLEY, Box 323, Mount Vernon, N. Y. The object of the invention is to provide a machine gun arranged to permit the use of interchangeable gun barrels, of which one is water cooled, another is double, reversible and air cooled, and the third is a single air cooled barrel. Another object is to provide a perfect balance in the rotating cartridge wheel and to permit operating the crank shaft from one side of the gun instead of from underneath.

WALL CONSTRUCTION.—D. J. FLYNN, 190 George St., New Brunswick N. J. The invention relates to walls with air space between them. The object is to provide a wall construction formed of hollow building blocks and arranged to securely tie the building blocks of the inner and outer wall sections together to insure the formation of an exceedingly strong wall, which will prevent moisture, cold or heat passing through the wall to the inner face thereof.

BEADED FABRIC.—C. A. HANINGTON, 93 Crosby St., New York, N. Y. An object of this invention is to provide an ornamental fabric in which the design is formed by clusters of beads, the beads being secured together and to the fabric by adhesive material. A further object is to provide a beaded fabric which is capable of bending or movement in all directions without injuring the beaded design.

CLOTHESLINE SUPPORT.—D. E. ROGERS, Dunlap, Iowa. The invention relates more particularly to that type of support including swinging cross arms to which the clotheslines are secured. An important object is to provide a support which will permit the cross arms to be adjusted to any desired position about its



A FRONT ELEVATION, SHOWING NORMAL POSITION AND ADJUSTED POSITION

axis of swing but which will positively prevent any such movement as would allow the clothes to come in contact with the ground. The attachment may be secured to any ordinary post or suitable structure.

EDUCATIONAL APPLIANCE. — J. H. FROME, 461 Richmond St., Philadelphia, Pa. The object of the invention is to provide an educational appliance designed as an aid in teaching a native or a foreigner language. Another object is to enable a teacher to readily set up sentences for study by the pupils without requiring blackboard work or the like.

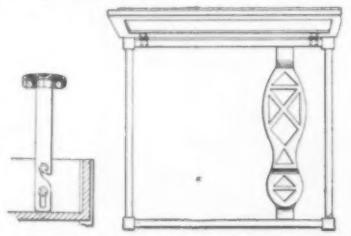
STANDARDIZED ACCOMMODATION-LADDER SYSTEM.—H. S. PAUL, 16 Market Square, Portsmouth N. H. The object of the invention is to provide a standardized accommodation ladder system for marine vessels, arranged to permit adjustment according to the fore and aft sheer of the vessel. Another object is to make the ladder in sections to fit vessels of different freeboard, and to permit of its being conveniently and quickly placed in position for use on the side of the vessel.

KNIFE.—E. LEWIS, 425 So. 16th St., Terre Haute, Ind. The object of this invention is to provide a knife especially adapted for use with prepared roofing, linoleum, felts, cardboard, paper, leather and the like, and in marking, splitting, trimming, and cutting, and also adapted for use as a pruning knife for trimming shrubbery, vines, trees and the like.

SAFETY COAL CHUTE COVER.—A. STATZMAN, 1017 Simpson St., Bronx, N. Y. This invention relates to covers for manholes, coal chutes, etc., and has for an object the provision of a construction which embodies as its essential feature safety resulting from a locking mechanism and associated parts for continually holding the cover near the chute and for locking the cover when closed. Another object is to provide a hinge and spring so that when the casing is unlocked it will automatically move to a partially opened position.

MAP CASE.—A. E. ALLEN, 26 E. Cypress Ave., Redlands, Cal. The invention has for its object to provide a map case, especially adapted for holding and displaying maps wherein a folding table is provided, having at each side a case, a roller being journaled in each case for supporting the map, and the map being arranged to move over the table when unrolled.

SHOE SHINING STAND.—N. J. GRENISON, 2620 Briggs Ave., Bronx, N. Y. The invention relates more particularly to a foot rest for shoe-shining stands. The primary object is to provide a shoe-shining stand



A PLAN VIEW OF THE STAND, AND VERTICAL SECTION OF THE FOOT REST

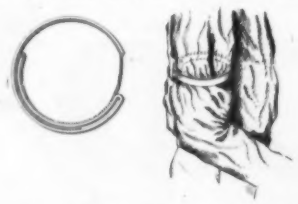
in which the foot-rest is adapted for folding within a suitable receptacle or box-like structure, and at the same time, provide necessary space for the storage of shoe-shining articles such as brushes, paste, polishing cloths, etc.

ADVERTISING DEVICE.—J. Z. HANSON, 237 W. 13th St., Fort Worth, Texas. An object of this invention is the provision of a removable advertising device which may be placed on street corners and bear the names of the streets or avenues, and also serve as a waste receptacle, and shall not occupy more space than is employed at the present time for receptacles of this nature, although it may be capable of being adjusted to receive various sizes of placards.

REFRIGERATOR. — F. L. HEWITT, Winchendon, Mass. The object of the invention is to provide an ice refrigeraotr having an outer box and an inner box, and partitions interposed between the walls and the boxes to provide double air spaces, thereby dispensing with fillings of insulating materials such as sawdust, asbestos, fibers and the like. Another object is to permit of assembling the boxes to hold the same in spaced relation without skilled labor, or the use of nails, screws or similar fastening devices or special fittings.

DOUBLE-CURRENT SYRINGE. — J. K. MITCHELL, Memphis, Tenn. The invention has for its object to provide mechanism, wherein by means of a single instrument, athorough irrigation may be had with thorough drainage. The device comprises a branched tubular casing with a perforated cap, the casing being adapted for holding liquid, and having a web at the junction of the branch and an opening just below the branch, which when in use is closed by thumb engagement, when the thumb is ermoved the cavity is permitted to thoroughly drain.

SLEEVE HOLDER.—J. S. JOHNSON, Emporium, Pa. The invention refers particularly to holders for holding shirt sleeves which exceed the arm length of the wearer so that the cuff end may always be in proper juxtaposition. The device is simple in construction,



A SECTIONAL VIEW AND THE DEVICE IN USE

easily applied, and retains its effectiveness; will not injure the shirt sleeve, nor exert undue pressure on the arm and cause injury thereto. The device is inexpensive to manufacture, and may be made in a wide range of material.

Hardware and Tools

WIRE FENCE.—R. KNAUR, Vienna, Austria. This invention relates to a wire fence or net, and has for its object to provide a fence which can be manufactured at a cheap cost and stored or transported with its meshes closed, thereby greatly reducing the space occupied by a fence of given area, and stretched, opening its meshes on the place where it has to be used to the desired length.

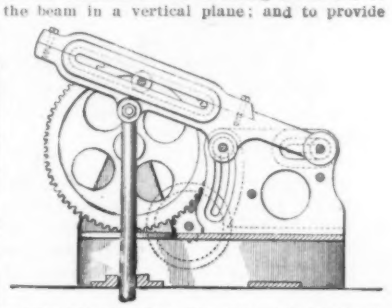
Heating and Lighting

GAS GENERATOR AND BURNER.—E. E. SMALL, 1010 So. Crinceton St., Portland, Ore. One of the principal objects of the invention is to provide a gas generator and burner especially adapted for use in ranges, heating stoves, furnaces and the like. Another object is to provide a generator and burner adapted to use coal oil as a fuel, the oil being volatilized in a chamber forming part of the burner and fed in the form of gas from a hollow finger communicating with the chamber.

RADIATOR.—K. MEIER, c/o Heizung Lufting, Winterthur, Switzerland. The object of the invention is to provide a sectional radiator for direct heating, whereby the front facing the room is designed to favor the emission of radiant heat, while the back turned against the wall is formed to increase the heat emission by convection, that is by contact with the air,. which will carry it to the room.

Machines and Mechanical Devices

PUMP.—A. CARD, c/o J. W. ASHLEY, 880 N. Andrews Blvd., Los Angeles, Cal. The general objects of the invention are to provide a pump in which the walking beam is so mountel and actuated as to vibrate on a center shifting to and from the vertical line of the pump rod in addition to the vibrating movement of the beam in a vertical plane; and to provide



A SECTION SHOWING THE WALKING BEAM APPROXIMATELY AT THE END OF THE UPSTROKE

guide means for the beam in its vertical vibratory movements and for the pin constituting the shifting center, whereby the pump rod will be given a direct rectilineal reciprocating movement without friction and without guide means for the rod.

CONCRETE TAMPER.—A. F. PARKER, address Robb & Robb, Schofield Bldg., Cleveland, Ohio. This invention relates particularly to the method of tamping concrete for road construction. The invention is directed toward the provision of a machine for compacting concrete of a proper dry consistency, thus producing great strength where an excessive amount of water is used. The tamper includes a plurality of vertically disposed long, narrow blades having substantially parallel bottom edges to engage the concrete, said bottom edges being serrated.

DOUGH-MIXER.—W. F. DEHUFF, Glen Roch, Pa. The invention has for its object to provide a machine wherein a thorough agitation and blending of the material may be obtained, a bowl or mortar being provided and a pestle or beater, having a rotary movement and a bodily movement of transition to different parts of the mortar, and wherein means is provided for independently varying the speed of the vertical movement, and the speed of the transition.

WRAPPING MECHANISM FOR CANDY.—M. B. FERGUSON and E. HAAS, 462 E. 29th St., Brooklyn, N. Y. The invention is particularly designed for wrapping cylindrical or prismatically-shaped candies An object is to provide a candy-wrapping machine which can form part of a machine for labeling, packing and otherwise manipulating candies after they have been wrapped. The machine can be employed for wrapping any articles of approximately cylindrical form.

(*Continued on page 372*)

UNDARK

RADIUM LUMINOUS MATERIAL

"I want that on mine"

Supposing you are taking an evening walk in the park, or are returning home from the theatre, or are in a sleeping-car berth at night, if your watch has an UNDARK dial you can tell the time at a glance; it's a true **24**-hour timepiece.

UNDARK doesn't get dark in the dark

It contains real radium and keeps glowing for years.

This radium luminous material is being used by the best makers of pocket and wrist watches, as well as by the foremost manufacturers of clocks and instruments in the country. Auto gas gauge makers also recognize its value for night driving.

You want UNDARK on your electric switch buttons and pull-chain pendants, door locks, house numbers, on pistol sights, flashlights, etc., because it assures convenience and safety.

We are miners and refiners of radium-bearing ore; pioneer manufacturers of radium luminous material in this country and the largest in the world.

Our service of instruction and inspection encourages the application of UNDARK by manufacturers in their own plants

Radium Luminous Material Corporation, New York

Factories: Orange, N. J. **Mines: Colorado and Utah**

Trade Mark Name UNDARK Reg. Applied for

UNDARK is used on numerous articles, of which the following are the most important

Watch	Gasoline Gauges
Clock	Speedometers
Flashlight	Steam and Pressure Gauges
Full-Chain Pendant	Revolvers
Push-Button Switch	Telephone Mouthpiece
Door Bell	Fire Extinguishers
House Number	Mine Signs
Hospital Call Bell	Women's Felt Slippers
Ship's Compass	Fish Bait
Locks	Theatre Seat Numbers
Safe Combinations	Convention Buttons

Poison Indicators

Names of the makers of these furnished upon request

RECENTLY PATENTED INVENTIONS

(Continued from page 370)

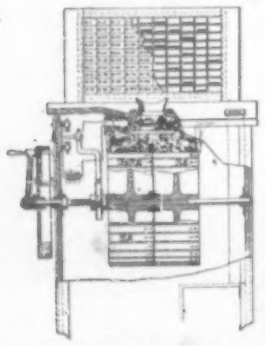
Machines and Mechanical Devices

ENGINE CYLINDER AND BED.—D. O. BARRETT, 260 Stephenson St., Freeport, Ill. This invention relates to engines of any desired type, either horizontal or vertical, and has for an object to provide a construction whereby the cylinder is held in position without presenting unsightly flanges and bolts. Another object is to provide a construction wherein the cylinder will fit the body at two points whereby a perfect alinement is easily secured.

PROCESS AND APPARATUS FOR THE OPTICAL STUDY OF THE MOTION OF MECHANISMS.—I. KOECHLIN, Paris, France. The invention has for its object to provide an apparatus which will allow of studying in a manner analogous to the stroboscopic method, the movements of any mechanism having rotary or any periodic motion. The apparatus consists in illuminating the mechanism to be studied by means of a source of electric illumination that produces instantaneous flashes at intervals of time depending on the duration of the cycles of motion of the mechanism.

DIRT-LOADING MACHINE.—J. H. MCKENNA, 1817 Adams Mill Rd., N. W., Washington, D. C. One of the principal objects of the invention is to provide a machine for use particularly in mines. Another object is to provide a machine having an adjustable plate for lifting the dirt from the mine floor, and disposing it into the conveyor, the machine being designed with particular reference to advantages of simplicity, durability, efficiency in operation, and economy in manufacture and maintenance.

ACQUAINTANCE-PROMOTING MACHINE.—C. J. WITZOREK, 22 Park St., Millvale, Pa. This invention relates to a machine adapted to be used in confectionary and other stores for running acquaintance-promoting clubs. The



A FRONT VIEW OF THE MACHINE, PARTS BROKEN AWAY TO SHOW CONSTRUCTION

machine comprises a cabinet having a view opening, a pocket drum mounted in the cabinet, means for rotatably and axially moving the drum to bring any desired pocket in registry with the view opening, and a scene element disposed between the view opening and drum and having a slot therein through which any desired picture can be seen.

PITMAN.—J. WARDENER, Sr., 276 Buzzington St., Fall River Mass. This invention has for its object to provide a device especially adapted for use with looms for connecting the reed with its operating mechanism, wherein the pitman is made adjustable to permit compensation for wear, by providing this prope radjustment, there will be no thin or thick places in the cloth, nor will the operator have the trouble of picking out misplaced threads.

PISTON ROD PACKING.—W. C. DRUM, U. S. National Bank Bldg., Portland, Ore. The object of the invention is to provide a packing of simple and inexpensive construction, easily applied to existing piston rods, and without material change therein, and which will provide a fluid-tight joint. The ring is composed of three sections and is arranged with the splits of the three sections staggered, or breaking joint with the splits of the other sections.

AUTOMATIC MAIL CATCHING AND DELIVERING APPARATUS.—M. and A. T. BOOM, R.F.D. No. 1, Box 45, Blanden, Neb. An object of the invention is to provide a device adapted more particularly for use on rural routes, and is so arranged that it does not require observation to insure its operation after the various parts of the machine are once set. Another object is to provide a catching and delivering apparatus which includes a truck which is provided with receiving and delivering boxes, arranged to coöperate with combined delivery and receiving boxes disposed at stations along the route.

LOCK-BEARING FOR THE COMPOSITION ROLLERS OF PRINTING MACHINES.—C. WINKLER, Berne, Switzerland. The bearing provided by this invention is mounted in the frame of the machine by means of a pivot pin about which it can swing and it is provided with a head piece to slide vretically, both movements being adapted to be effected by hand screws, which enable the lateral and vertical adjustment of the roller to be effected with the greatest accuracy. In the position thus adjusted the bearing is fastened by a suitable bolt or other locking device.

Medical Devices

MASK.—J. A. DOBEY, Johnston, S. C. The invention has for its object to provide a device adapted for use by doctors, nurses and the like, when in the presence of patients

A PERSPECTIVE VIEW, SHOWING THE MASK IN USE

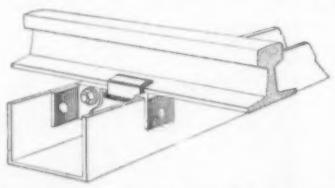
suffering from influenza, meningitis, and other diseases communicated through discharges. The mask is made of gauze, secured by a frame of wire, and held to the face by means of a cord; a pledget of cotton may be connected with the mask to hold an antiseptic or the like.

Railways and Their Accessories

TRACK LEVEL.—H. MATOBA, 820 Washington St., Seattle, Wash. This invention relates more particularly to a device which comprises a beam, means near one end thereof for engaging a track rail, and a vertically adjustable measuring element near the other end of the beam, fo rdetermining the degree of "banking" at any particular part of the track. The invention further relates to a track level having an adjustable measuring element provided with suitable graduations in combination with means for securing the measuring element in different positions of adjustment.

TRACK GAGE AND LEVEL.—H. MATOBA, 820 Washington St., Seattle, Wash. This invention relates to track gages and levels, and more particularly to a combined track device comprising a beam having a track engaging gage members, and a level determining means the normal axes of which is at an angle with the normal longitudinal axis of the device. An object is to provide a simple durable and inexpensive device for determining the gage and the level of railway and other tracks which can be readily manipulated, is compact in form and light in weight.

TIE AND RAIL FASTENER.—H. A. BERQUIST, St. Croix Falls, Wis. The invention has for an object to provide a structure in which any size rail may be readily clamped in position on a metallic supporting tie. Another object is to provide a metallic tie and fastener



A PERSPECTIVE VIEW OF A TIE, WITH FASTENER THEREON

arranged with the fastener rigidly secured to the tie and retaining members associated with the fastener to clamp the rail in position thereon while admitting of an adjustment in either direction.

SELF-ALINING BEARING-BOX AND AXLE FOR MINE CARS AND THE LIKE.—T. A. PARKER, 5701 Natural Bridge Ave., St. Louis, Mo. One of the principal objects of the invention is to provide an axle and truck, incorporating in its assembly bearing-boxes of such construction and design that they will be self-adjusting, whereby the axles will be kept in alinement at all times. A further object is to provide means whereby the bearing-boxes may be permanently attached to the car in a convenient way.

Pertaining to Recreation

COASTER.—F. THOMAS, Roanoke, Va. This invention has for its object to provide a simple inexpensive wheel coaster which may be manufactured at a low cost, and which will be strong and efficient for the purpose. The coaster is designed for use on any hard surface suitable for the purpose, and some skill is required to coast on the two center wheels by balancing the car, two small wheels are provided a tthe sides to prevent overturning.

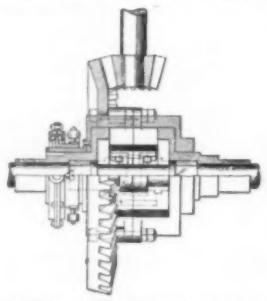
AIRPLANE PLEASURE-RAILWAY.—F. M. WILLIAMS, 31 Nassau St., c/o Sayers Bros., New York, N. Y. An object of the invention is to provide a pleasure device such as are extensively used in pleasure resorts. A further including a single main supporting rail and a novel form of carrier, this carrier because of the mono-rail structure being made to possess, especially in side elevation, the appearance of a monoplane aircraft.

JUMPING TOY.—F. S. NEYD'HART, 262 Palisade Ave., W. Hoboken, N. J. The invention relates to toys of the aerial projectile type. Among the objects is to provide a toy of suitable appearance preferably simulating a well-known insect or animal and having a member so constructed and attached as to act as a projecting means, the same being a permanent or integral part of the figure.

Pertaining to Vehicles

AUTOMOBILE SKID-CHAIN FASTENER.—O. PATRIQUIN, Weston, Mass. This invention relates to a fastening device which may be connected to a chain substantially at any point and to the wheel of the automobile for holding the chain against accidental removal. The clamping device is arranged on the spoke of the wheel and provided with means for receiving the ends, rings or links of an anti-skid chain, whereby the accidental losing of the chain is prevented in case of breakage.

DIFFERENTIAL.—L. WATKINS, 826 St. Charles St., New Orleans, La. An object of the invention is to provide a construction which may be used either as a rear or front driving differential on a four-wheel driving vehicle. A further object is to provide a differential in which the usual arrangement of



A VIEW OF THE INVENTION PARTIALLY IN ELEVATION, PARTIALLY IN SECTION

the internal gears and connecting members are eliminated and simple clutches substituted which may be manually actuated at the time the clutch is drawn in and out or independent thereof in connecting and disconnecting the power shaft with the wheels.

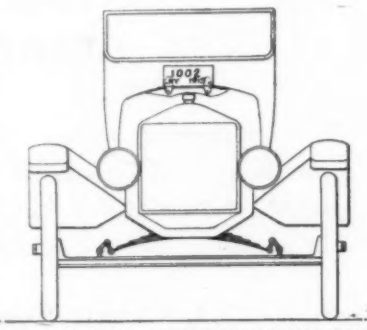
SPRING OILER.—G. A. TUTTLE, Anatone, Wash. The aim of this invention is more particularly to provide a device in which the individual leaves of the spring may be reached by oil distributed from a common inlet. A further object is to provide an oil cup mounted in a screw-threaded opening and communicating by passage to the leaves, which are formed with grooves extending longitudinally but terminating adjacent their end portions.

STEERING WHEEL FOR AUTOMOBILE.—C. T. SILVER, 100 W. 57th St., New York, N. Y. This invention has for its object to provide a steering wheel which will not obstruct the vision of the driver, and which will not prevent the easy passage of the occupants across the automobile in front of the steering wheel. To accomplish this the wheel is constructed with its front much nearer the axis of the wheel than the sides and rear of the steering wheel.

CUSHION TIRE.—C. S. WERT, 602 N. Main St., Kendallville, Ind. An object of the invention is to provide a cushion tire including as one of the important features a plurality of resiliently supported shoes arranged to occupy and engage the inside of the tire casing and take the place of the compressed air ordinarily employed to hold the tire in shape. Another object is to provide a tire casing in the cushion members which include a plurality of spring supported shoes with a ring surrounding the felly and providing a mounting for the spring.

WHEEL LUBRICATOR. — J. HUTCHINSON and C. C. HAMILTON, Gull Lake, Sashatchewan, Can. An object of the invention is to provide a simple device applicable to wagon wheels for feeding grease or other hard lubricant, one which is manually operable and which can be readily applied to any ordinary wheel of the type using a wooden hub and end metal axle bars. Another object is to provide a grease cup having an adjustable cap and means for holding the cap against loss from the cup.

LICENSE TAG BRACKET.—C. H. PEASE, Canaan, Conn. The invention relates to tag brackets adapted to be secured to the dashboard of an automobile, and secured in such a position that it can be conveniently seen, yet entirely out of the way. A further ob-



FRONT ELEVATION OF AUTOMOBILE ILLUSTRATING THE INVENTION AS APPLIED

ject is to provide a bracket which can be manufactured at a low price, which can be placed in position by any one, of average intelligence and will be strong and durable in use.

CARBURETER ADJUSTER.—R. M. and H. R. DONALDSON, R.F.D. No. 4, Claysville, Pa. The invention relates to carbureter adjusters especially adapted for use with Ford cars, for permitting the carbureter to be adjusted from the seat, without the driver taking his eyes from the road. In operation, the extent of valve opening, that is the adjustment of the carbureter, may be controlled from the handle.

WHEEL.—P. A. TOURTIER, c/o Tourtier Wheel Co., 222 Market St., Cole Bldg., Newark, N. J. This invention relates particularly to pneumatic wheels which will include all of the tractive properties and ease in riding of the pneumatic tire and still remain puncture proof. The invention has to do with a wheel including a plurality of radially movable pistons, each under air pressure so as to effectively cushion its inward movement, and each carrying its respective section, of the sectional thread, the hub of the wheel being hollow to form a compressed air chamber.

AUTOMATIC AIR RELEASE.—H. J. RICKON, 201 Central St., San Francisco, Cal. The object of the invention is to provide an attachment to be applied to a wheel of an automobile having pneumatic tires; the device includes an element movable under centrifugal force to engage the valve for opening the latter to release the air from the tire, so that should the automobile be started by an unauthorized person, the turning of the wheel will produce a flat tire. The attachment may be set to automatically open the valve, or held from functioning.

PORTABLE ELEVATOR.—H. R. KEES and E. F. THOMAS, c/o Panhandle Lumber Co., Pampa, Tex. The invention relates to portable elevators in which the rear wheels of a truck will rotate rotating the wheels which in turn will drive the elevator. The object is to provide a cheaply constructed yet efficient device, capable of being transported from place to place, and especially designed for unloading trucks.

Making Farms Out of Deserts

(*Continued from page 358*)

Mr. Arthur Powell Davis, Director of the U. S. Reclamation Service, has recently explained, there are distinct advantages in irrigation farming in arid areas which are not enjoyed in humid regions. The soils of arid sections of the country, by reason of the lacking or the deficient rainfall, have as a rule not been leached of their mineral plant foods as is so often the case where precipitation is abundant. Therefore the arid lands are potentially fertile and are seldom, if ever, acid or "sour"—a condition that is frequent where the ground has become saturated. While arid areas are sometimes charged with hurtful alkalis, which seldom remain in the soil in humid regions where they are carried off owing to their solubility, still these objectionable salts do not predominate, and the general abundance of mineral plant foods does make the land of the chosen project especially adaptable to profitable irrigation.

Where Nature alone determines when the rain will fall farming is something of a gamble. On the irrigated tracts, on the other hand, the husbandman is able to apply water to his growing crops at just the right time and in just the quantity needful to stimulate growth, and, conversely, it is in his power to withhold undesirable moisture. Further, mainly because Nature keeps back the clouds where she is stingy in precipitation she compensates by a preponderance of clear days. Therefore, in arid regions the sun shines the greater part of the while, and the stimulating rays speed up and promote healthy, vigorous plant growth.

As a consequence, there is a conspicuously larger measure of product obtained from irrigated lands, and their proper management permits of a more deliberate and intensified cultivation. That is to say, it is possible to obtain from an irrigated tract of 40 acres quite as much as could be realized from the average 80-acre area in a humid region. It is true that irrigation requires more labor per acre to make the most of the soil's fruitfulness, but the percentage of this labor is actually less in proportion to the yield.

As a logical outcome of the labor factor, and the practice of intensive cultivation, the working of smaller holdings appeals, and this leads to a greater centralization of population than would ordinarily be the case in the usual agricultural territories. It follows, then, that the isolation of country life is much reduced and the irrigating farmer has fully twice as many neighbors within a given radius as his industrial fellow in a humid district. This brings in its train certain social gains and leads to a measure of coöperation of a marked sort. Mr. Davis declares: "This condition stimulates the civic conscience and attention to public affairs of common interest, so that the local governments that grow up under such conditions are usually of a superior order and controlled by a superior intelligence on the part of the population living thereunder."

According to the Annual Report of the Reclamation Service covering the fiscal year from 1918-19, the value of the agricultural products, exclusive of livestock, produced on the several Government projects during the season of 1918 amounted to nearly $67,000,000—more than half of the net cost of construction work on all the projects since the enabling act of 1902. It seems that on some of the reclamation projects the 1918 production exceeded the entire construction outlays. This is not to be wondered at when it is recalled that in the Yuma Valley, for instance, the yield per acre averaged a value of $113, while the fields of the Yakima projects in the same season produced crops worth $9,700,000—coming within $300,000 of their total Federal expenditures up to date!

It should be borne in mind by every taxpayer that the money expended upon

the 26 projects located in 15 states west of the 100th meridian has been in the nature of a loan, and the early fear that the Government was taking a grave risk with the public funds involved has now been fully dispelled by reason of settlements that have been made possible through the industrial profits thus realized. According to official figures, it seems that up to June 30th, 1919, the accrued construction charges amounted to $8,052,372, of which $7,530,870 had been paid, leaving the comparatively modest sum of $521,000 still due—most of which has since been collected. The aggregate of operation and maintenance charges in the last fiscal year was $5,460,045.29, of which only $560,607.77 was unpaid. Water-rental charges totalled $5,627,694.29, of which but $107,960.07 was the unsettled balance. There are precious few, if any, private enterprises of kindred magnitude that can make such a remarkable showing.

The Government's reclamation projects have already provided homes for 400,000 inhabitants in communities where agriculture is booming. But a few years back lands given over to sage-brush, cacti, rattle snakes, Gila monsters, sand storms, and the withering radiation of the sun are now transformed into gardens, waving fields, and orchards. Farms of from 40 to 80 acres are yielding annual revenues of thousands of dollars each, and this from soil which, before irrigation, could not be sold for thirty cents an acre. This metamorphosis could not have been wrought but for the careful planning and the skilful execution of our irrigating engineers of the Reclamation Service.

These men have defied nature in her angriest and most austere moods. In effect, they have made rivers climb mountains or they have lowered the surrounding terrain so that the beneficent flow of otherwise inaccessible streams could be diverted upon the arid wastes to make them bloom. Reservoirs capable of impounding many millions of acre-feet of water have been called into being or are in process of completion. Storage dams ranging from modest heights to towering altitudes of 300 feet and more and formed of 22,500,000 cubic yards of material have been reared. Diversion dams of varied and ingenious types have been planted across numerous waterways; and canals totalling 2264 miles have been dug. Finally, tunnels have been driven, barriers of rock and earth have been pierced for distances varying from a few feet up to 5.8 miles, that water in perilous and apparently inaccessible places might be tapped and led by great man-made arteries to widespread areas of famished soil.

It is popularly supposed that once the miracle-working moisture has been given to the irrigated acres nothing more is necessary on the part of the Federal Reclamation Service. The men in the street imagines that the thirsty earth greedily drinks up the water and that plant growth and evaporation do the rest. As a matter of fact, however, such is by no means the case; and no small part of the operative problem is to dispose of the water after it has sunk into the soil. The Director of the Service has recently adverted to this angle of the Bureau's activities in the following fashion:

"The industry of irrigation by which water is applied to the surface of the soil for the growing of crops is necessarily attended by a considerable escape of such water to the subsoil, where in most cases it joins ground water, and this gradually rises. Such a conditions is, of course, aggravated and expedited by wasteful applications of water, and this is very difficult to avoid if the soils are open and porous; but even in case of tight soils and a reasonably economical use of water some rise of ground water is likely to occur, and very few irrigated regions of magnitude exist in the world which have not attached to them an important drainage problem. Accordingly, during the last few years one of the largest and most important activities of the Reclamation Service has been the provision of suitable drainage works on the various projects where these are required."

Therefore, pumping plants of considerable magnitude are frequently needed both for the original distribution of the water and then its subsequent withdrawal to guard against the soils becoming sour through excessive dampness or continual saturation. As may be readily grasped, this pumping service is of a seasonal character, and the electrical installations which supply energy for that and other purposes could be run only at a loss, because of the overhead, if it were not possible to keep the stations actively employed the year through. How is this done? On the Mindoka project in Idaho, for instance, current is sold for about half the year for electric heating, and one kilowatt per month costs $1.60 and has the heating value of a ton of coal! Think of it, no ashes, no carrying or shoveling of coal: nothing to do but press a button or throw a switch to command energy yielding 100 per cent heating efficiency!

More than common interest is warranted at the present time in our Reclamation Service because the Government is opening a large acreage to entry upon the North Platte and the Shoshone projects and preferred right of entry for a period of not less than sixty days is extended to the men of our fighting services called to the colors during the recent conflict. Between 100,000 and 200,000 inquiries have been received from these "veterans." It is reasonable to suppose that a very considerable number of them will thus be drawn to agriculture and placed in an atmosphere where examples of success will play a potent part in helping these men to make the most of their now-found opportunities and to become added sources of national strength.

Gasoline from Natural Gas

(Continued from page 359)

cess also saves the resultant condensate with a minimum of loss.

The gasoline made by this process tests on the Baumé scale from 80 to 100 degrees and to make it a commercial product permissible of being shipped on a common carrier, is mixed with commercial naptha. The blend obtained in this manner is from 60 to 70 degrees Baumé. This residue does not evaporate as quickly as the original condensate.

Every modern gasoline plant which makes gasoline from natural gas uses the above system and today the industry is an important part of the oil industry not only in the eastern fields but in all fields.

A so-called "wet" gas is necessary to enable the producer or to make gasoline in paying quantities. Natural gas is made up, mainly, of paraffine molecules which appear in the form of hydrocarbons mixed with small portions of nitrogen, carbon dioxide and water vapors. From a chemical standpoint a sample of "wet" natural gas would contain:

Methane	37.4 per cent
Ethene	32.0 per cent
Propane	20.1 per cent
Butanes, Petanes, Hexanes, etc.,	10.5 per cent

Dry gas will contain, upon a chemical test, as high as 95 per cent methane, which is a substance that cannot be liquefied and consequently, oil men having in mind the establishment of a gasoline plant, employ a trained chemist to make a test of the flow of gas and to determine if the gas can be liquefied to a commercial point.

Contrary to the accepted opinion, the extraction of gasoline from natural gas does not seriously affect the heating units in the gas. A consensus of opinion indicates that from 2 to 4 per cent of the heating units are lost. As a result of this, all companies selling gas for light

and heating purposes are now using a gasoline extraction plant through which the gas is run and have greatly increased their revenues.

In the eastern oil fields, the nautral gas has been turned into gasoline and many of the oil producers that were about to sell their slowly declining oil production or abandon it altogether have been saved from this situation and are today making more money in a week from the sale of their gasoline than they make in a month from the sale of their oil production. The cost of a plant with all machinery is nominal, in spite of the demand, and where millions of cubic feet of gas has been wasted by escaping or burning, it is now being turned into a steady income.

The industry is growing steadily and it is almost impossible to secure correct figures upon the present output. The writer is able to present but few comparisons for this reason. In 1916, one authority submitted figures showing that 65,364,665 gallons of casing-head gasoline were made which sold at an average price of $.079 a gallon with a total value of $5,150,838. The same authority is responsible for the statement that one year later in January, 1917, the state of Oklahoma had 95 casing-head gasoline plants with a *daily* production of 200,000 gallons. This would mean a yearly production of 19,000,000 gallons from one state alone and it is certain that Kansas, Texas and other oil- and gas-producing states are making an equal, if not larger production.

Testing Paper by Tearing

(*Continued from page 359*)

which is much in the nature of a pendulum, is provided with an adjustable weight and is shown in the illustration raised almost to the horizontal and supported by the framework.

The machine, as shown in the illustration, is ready for testing. All that is necessary is to release the pendulum and let it swing downward carrying with it the wheel and the wire, thus pulling the letter clip upward and tearing the sheets of paper. After the tearing has been completed the pendulum continues to swing to the other side and the total arc of swing is measured by means of the small pointer which will be noticed at the top of the wheel. The pendulum will not swing as high on the right side as in its original position on the left side and the difference between these two values is a measure of the work required to tear the paper, which again is a measure of the tearing resistance.

The Mill Stand and Its Work

(*Continued from page 359*)

end of each platform. One of these tables inclines from the level of the rolling mill to a higher level at the right. At the extreme left of the picture there are heating furnaces, heated by oil, in which the steel ingots or slabs are brought to a red heat.

In operating, the white hot masses of solid steel are brought out of the heating furnaces at the left and mechanically placed on the long table adjacent thereto. This table can be brought in front of any set of furnaces in the plant because it travels electrically on the rails underneath. The hot steel is then transported in this platform up to the rolls by means of a set of small rolls or wheels which are visible on top of each platform. A slab of steel can be seen passing through the rolls and reaching the right hand inclined platform. From there it is also transported on rolls to the floor level on the right where it passes to other portions of the plant for further treatment. The two traveling platforms can thus operate on each side of any of the three or four sets of rolls in the center, and also in front of any of the heating furnaces at the left.—By *A. R. Surface.*

Exploiting the Inventor—I

(*Continued from page 360*)

search" and tell you in five minutes whether or not your patent can be obtained. He doesn't hold himself cheaply. He doesn't give you a piece of government paper with some words printed on it and call it a patent. He gets you a real patent which is as valuable as the invention it covers, or he doesn't get you any patent at all.

Inventors who want to have their inventions pay dividends should realize first, that a patent is not necessarily valuable; one can only say that a patent which fully covers an invention *may* be as valuable as the invention. They should learn, second, that a valuable patent is seldom prepared or produced by a shyster whose only interest is his fee. The father who would take his child to the cheapest doctor may well take the child of his brain to the cheapest lawyer, but the parent with a heart gets a good doctor for his offspring and the inventor with a brain gets a good lawyer to obtain a good patent.

These are the law and the prophets both of success in the field of invention. A good patent is the foundation, and a good patent is seldom or never obtained save by a reputable and reliable firm. Make sure of the character of the attorney you employ . . . it is a better guarantee of the quality of your patent than any advertisement ever published.

Piercing New Zealand's Mountain Barrier

(*Continued from page 363*)

strike had occurred. At the Bealey end the progress has been very irregular, the work being idle for a year or more owing to the water difficulties.

As regards the completion of the tunnel, if another 100 men are obtained, thus enabling another shift to be put on at the Bealey end and two extra shifts at Otira end and more facilities given for coöperative contract work, the lining of the tunnel should be completed in less than two years. The main thing, however, is that when the lining is completed the material for electrification should be ready for installation, four schemes having been submitted to the Government.

Towards the end of October, 1919, the Minister of Public Works stated that at the Otira end all work during the year had been carried out by day labor. The bottom heading had been driven 691 feet and approximately 200 feet of this timbered. Slow progress had been made with the enlargement and lining, owing to the difficulty of obtaining suitable labor. At the Bealey end work for the first half of the year continued on the day labor system, but was changed to contract in September. The bottom heading was driven 413 feet, where it met the drive from the Otira end. The progress of enlargement was hampered for the same reason as at the Otira end.

From the Mountains of Montana to the Tetons of Wyoming

(*Continued from page 364*)

a view of Yellowstone Lake with the Tetons looming majestically fifty miles away.

Turning to the north we reach the Grand Canyon of the Yellowstone. The view from Artist Point on the eastern rim is the most comprehensive and satisfying of all. Both walls of the Canyon are seen to advantage and the Great Fall which is about twice the height of Niagara occupies the center. For three miles below the fall the rhyolite rock of the canyon has been colored by the fumes of hot springs. The effect is like a painting in water colors; yellows predominate with pinks and whites and rarer touches of crimson. In no way is it comparable with the rich coloring of the Grand Canyon of the Colorado, but it has a unique delicacy that is a delight to all lovers of

beauty. In the early morning I have watched its colors gradually awaken until the sun turned backward the curtain of shadow into the heart of the canyon. Little clouds of mist float upward from the fall and vapor rises from the hot springs along the edge of the river. Beneath the forest which peers over the rim are cliffs of yellow and orange; across the canyon the upper wall is chalky white. Pines and spruces are scattered among the innumerable multitude of fretted and varicolored pinnacles which adorn the slopes; while the river is deep green and foamy white where there are rapids. Resting over all is the soft blue of the sky. Ospreys sail back and forth through the canyon, now and then alighting on some inaccessible pinnacle where their young are nesting. In the contemplation of a scene so vast and beautiful the soul demands appropriate silence that it may hear the music of nature. In former years I have found the canyon secluded from irreverent noise, but now no spot remains where one may escape the incessant shrill exhaust whistles of automobiles. For several hours a day and into the night their irritating sound crosses from either side. Some day we hope it may be possible to arrange for rapid transportation in a manner more in keeping with the grandeur and peace of the canyon. Among many other points one should visit Inspiration on the opposite rim. Its view is less symmetrical than that from Artist Point, and it lacks the full view of the great fall, but the wild grandeur of the canyon is more apparent.

Descending the ravine near the Lower Fall at sunset, we reached the river. Clouds of rainbowed spray sweep out from the fall upon the slopes where the mosses gather, and trickle back to the river. Looking up we saw an osprey, laden with twigs for its nest, flying close to the glassy green brink of the fall. On one side the water plunges white and heavy, throwing itself outward upon a concealed rock; on the other it shoots downward in misty comets like soft silken floss. Following down the river until the walls became impassable, we found tiny hot water geysers with brown and green and white on their cones.

The nearby crumbling rock ranges in color from white to carmine. Years ago I climbed from this point directly up the treacherous slope of the canyon to the rim, which is about 1200 feet in height, but the temptation to slip back was very strong. Looking up from the river at sunset the cathedral crags are lit with joyous color. Peering into the depths of the canyon at night it is devoid of color, lying ghostly white in the moonlight.

From the summit of Mt. Washburn, 10,000 feet in height, which we reached in an auto, there is a comprehensive view of park-like forests and of many mountains on the horizon. The Yellowstone is a dying geyser field which is slowly turning into hot springs and pools of great beauty. After visiting the most interesting formations and geysers of the park, we left Old Faithful by auto for Moran, Wyoming, which is about 70 miles distant to the south. Passing through a heavily wooded country of high elevation we looked down on Shoshone Lake and had a distant view of the Teton Range which we were to reach that evening. At the west thumb of Yellowstone Lake we paused to view the Paint Pots with their bubbling mixture resembling rose colored calcimine, and a little geyser playing on the very edge of the lake. Turning south the road follows the shore of Lewis Lake, and then along Lewis River past colorful meadows and sparkling streams to the crooked Snake. We had near glimpses of deer, of elk, and of moose. Finally we reached the long valley of Jackson Lake which has been dammed at its southern outlet to control the waters of the Snake River for the benefit of Idaho lands. The water was low in the lake and for miles the dead trees created a gloomy landscape. Along its forested shores there is a wide margin of deep mud and of utter forest devastation. In turning a lake into a reservoir of larger area it is important that the standing trees be cut along the shore, and not be left to their death by water. Alas, the beauty of Jackson Lake has been unnecessarily ruined for years to come. On its shores and islands is a dense and muddy tangle of standing and fallen timber. Once a paradise for countless water fowl, the varying water levels have worked utter ruination. Even the birds and the animals desert its shores in disgust. From the slopes of the mountains one looks down upon ruined areas where the water has found its way inland, and, in traveling across country, one is unhappily confronted by these dismal swamps with their foul odor of decay.

From Moran there is a glorious view of the Tetons rising six to seven thousand feet above the western shores of Jackson, Leigh and Jenny Lakes. From Mount Moran, 11,100 feet in height, to far beyond the Grand Teton, 13,747 feet, in the south, rugged canyons alternate with unclimbed peaks that await the mountaineer. Some day a trail will follow the eastern shore of Leigh Lake and one of the most exquisitely beautiful views in America will be enjoyed by many. But it is proposed to make reservoirs of Leigh and Jenny Lakes, raising their level and ruining their charm. Each lake is only about two miles in length, although their corresponding shore lines are much longer. We do not question that it is desirable to increase our facilities for irrigation, but we ask if America cannot well afford to preserve these little lakes from ruination? They are among her most precious gems. It is even rumored that a movement is now quietly on foot to use Yellowstone Lake itself for irrigation purposes! We cannot believe that the thousands who have seen and loved its natural charms will enjoy the thought of the consequences. Let them visit Jackson Lake if they desire information.

It is proposed that 1,000 square miles of fine scenery, including the headwaters of the Yellowstone with the Teton Range, be added to Yellowstone Park. As these mountains are unique in their wild and rugged grandeur, they will form a fitting climax to the wonders of the park and will afford a splendid field for the mountaineer for many a day to come.

From Boneyard to Shipyard

(Continued from page 366)

spends itself. At the narrow inlet of the harbor some of its force may be felt; it is not here, however, that the shipyards are situated, but from three to five miles inland. This island of Alameda is low and flat yet with all its many buildings, trolley lines, electric railroad lines, it offers protection to the inner harbor from the winds that pour through the Golden Gate, that is not of slight consideration.

Favorable climatic conditions are very important in the building, launching and fitting-out of ships. The work of building is much exposed to the weather; therefore the better the surrounding weather conditions are the greater is the work facilitated. Calm waters and tempered winds are also important in the fitting out and finishing of the vessels as they lay moored at the fitting-out wharves. All these considerations were carefully weighed in deciding upon Oakland's inner harbor as a spot well fitted to the strenuous work in hand.

Through Oakland's inner harbor has ebbed and flowed the city's marine industry. During the fiscal year ending June 30th, 1918, vessels to the number of 51,142, and of a net register of tonnage of 2,624,172 tons arrived, bringing 853,811 tons of cargo. However, by reason of its protected waters, ample length and proximity to the port of San Francisco, it had for years been the dumping ground of marine derelicts, the anchorage of vessels tem-

porarily out of commission, and the repair shop for a vast assemblage of craft from all parts of the world. Consequently it gained the somewhat gruesome appellation of "The Boneyard," among nautical persons.

The shore lines of the inner harbor became a marine curiosity shop. Along them for miles on either side lay an array of small craft, many in a state of decay, others in process of repair, and still others under construction.

There were hulks of the old stern-wheel steamers which in the days of the Argonauts did good service in the navigation of San Francisco Bay, the Sacramento and San Joaquin Rivers, and other tributary waters. Decaying scows, barges and dredgers were beached along these shores. Some were being repaired for a little longer lease of life. Others were being wrecked and all were being looted by harbor pirates.

On the Alameda side a long line of house boats was moored and furnished comfortable, if not cozy, quarters for hundreds of humble families who thus escaped paying house rent in town.

But within the past year the Government threw consternation among the Alameda house-boat dwellers by an imparative order to "move on." The march of progress had hit the inner harbor and the great suction dredges must be put to work making the channel deeper, and the adjacent land higher.

There were always certain shipyards scattered along the placid shores of the inner harbor, engaged principally upon repair work. There was the omnipresent Southern Pacific Railway Company with its construction and repair yards on the Oakland side, devoted principally to the repair of its fleet of ferry boats which for years have done service on San Francisco Bay. Here, too, the S. P. repaired its Sacramento River steamers, car floats, etc., and from time to time turned out a new individual in some of these various classes.

A mile or so eastward, and still on the Oakland side, was the old original Moore & Scott yard where I used to go to get data about how the old ocean tramps were laid up for repairs, to have the barnacles scraped from their corroding hulls, and to get these treated to a new coat of marine paint. About a mile still to the eastward was the plant of the United Engineers Corporation, a concern engaged upon similar work. This plant, however, was situated on the Alameda side of the harbor. These two last mentioned formed the nuclei of the principal big shipyards of Oakland harbor. And upon this limited and somewhat crude foundation has been erected during the past three years one of the greatest shipbuilding industries in the country, if not in the world.

The largest demand in the Oakland zone of activity was for steel plate for the fabrication of the great hulls. This had all to be brought from the East, and it had to come by rail, because there was not at that time a cargo ship that could be spared from the immediate war forces. The Government, taking control of the railroads as well as the shipyards, arranged this matter, however, and great train loads of steel were routed through upon fast freight with hurry-up orders.

Happily both Oakland and San Francisco had long been in the business of constructing marine engines and auxiliary machinery, and their shops were at once put upon an emergency basis and speeded up to capacity limit. Many of these shops had made a study of the Diesel engine, and were prepared to turn out improved types of this popular machine.

But there had to be an enlargement of shipyards and an installation of up-to-date equipment. In the biggest of Oakland's yards there is not one machine in use today that was in use four years ago. On July 1st, 1918, there were but fifteen launching ways in all the Oakland yards

together. On July 1st, 1919, there were fifty-eight. So great was the push for ways and equipments that the building capacity of the Oakland yards at the opening of 1919 had been increased to 3,000,000 tons.

On July 1st, 1918, the working forces in the Oakland yards numbered 16,000 men. On July 1st, 1919, this force had been increased to 50,000 men.

To show the development of the industry in a single yard we give a few figures: In 1916 this company laid the first keel for an ocean-going steel vessel. This was a 7,100-tonner, 390 feet in length. It was built under private contract. During 1916 this company launched ten steel ocean-going steamers; one of these was a 10,000-ton tanker; two were 7,100-ton and six were 9,400-ton cargo carriers.

In 1917 the company signed in June contracts for ten 9,400-ton steel cargo-carriers; in December contracts were signed for ten more of the above class, besides six tankers.

In July, 1918, contracts were signed for ten more 9,400-ton cargo-carriers and six tankers. These contracts were all carried out. Later in 1918 contracts were signed for two 14,000-ton cargo vessels, and one 10,000-ton tanker. The company has constructed 42 of these vessels under Government control.

Multiple launchings have become a feature of the Oakland shipyards. In March, 1918, there was a triple launching—three 9,400-ton vessels sliding into the water within one hour. In May, 1918, there was a double launching; in July of the same year there was a triple launching of 9,400-ton vessels.

On December 20th, 1919 came the record-breaker. Within one hour six of these great ships, having a combined tonnage of 58,000 tons, were sent down the ways of the one company. Besides all its shipbuilding this company has been manufacturing 55-ton Scotch marine boilers for the shipbuilding yards at San Pedro harbor, Los Angeles. These boilers are eleven feet long and fifteen feet in diameter.

This company will further extend its business in 1920, having just purchased of the Western Pacific Railroad Company 351,918 square feet of land adjoining its present site on the west, where two floating dry docks of 15,000 tons lifting capacity each will be built, or of a capacity sufficient to handle the largest ships entering the Golden Gate. Work has already begun on these docks. The vice-president and general manager of this company has recently returned from New York, bringing with him contracts for additional vessels to cost in the aggregate 88,000,000. This work will include four tankers of the 10,000-ton type, each having a holding capacity of 72,000 barrels of oil.

Making Wax Dummies for Fashion Displays

(*Continued from page 367*)

in removing the plaster mold from the wax shell.

After the wax mold is removed from the plaster, it goes to an artist, whose duty it is to give life to the colorless plastic. He works his color well into the wax, rather than merely washing it over the surface. The insertion of the hair is also a delicate operation; it is done by machine, each individual hair being inserted separately into the wax.

But why are the arms and hands so natural? They are an exact replica of the living prototypes. Surely a sculptor of remarkable skill has carried out this difficult part of the work. Wrong! Quite wrong; for the truth of the matter is that the arms and hands are made directly from the model herself. That is to say, the model assumes any desired posture, and the expert molder proceeds to surround her arm and hand with plaster which soon hardens. The mold thus made is carefully broken apart so as to release the model, and is then ready to serve in the reproduction process. That, in brief, together with the skill of the artist who goes over the hands and especially the nails in the search for verisimilitude, accounts for the remarkable likeness.

Then head and arms are attached to the body of papier-maché and the figure is ready to be clothed and placed on exhibition.—By *Ralph Howard.*

Some Novel Uses for the Tattooing Needle

(*Continued from page 367*)

turns to beautification of the female cheek. He has up his sleeve another trick just as good as that. The man who retouches photographs by hand, taking out the things that do not appeal to the subject and putting in the dimples, etc., that the subject would like to believe are there, finds that working by hand, his best speed is about six negatives per day. But with the rapid tat-tat-tat of the electric needle in place of the more tedious manipulation by hand, he can double or triple this output. So if you should find your favorite tattooer busily engaged in tattooing a portrait, do not register doubts as to his sanity. He is merely turning an honest penny in an honest side-line.

The working details of the usual electric tattooing needle are shown in the insert. *A* is the handle of the electric pencil, as some prefer to call it; *B* the wire-like needle which passes through the handle and which is actuated by the armature *C*. *D* is a contact screw which can be adjusted to vary the stroke and rate of vibration of the armature. *E* is a switch for turning the current on and off. *F* represents the two binding posts, one back of the other. *G* represents a pair of electromagnets, which actuate the armature. *H* is the contact spring attached to the armature.—By *Alfred Krumm.*

A Botanical Romance

WE read in books on travel that the beaten paths of great caravans are strewn here and there with the bleached bones of those that have fallen by the wayside, unable to keep up with the procession.

So, in the onward march of time, some fail in the struggle for existence, and the path of evolution is marked, as with milestones, by extinct species, whose remnants we find buried in the soil or encased in the rock.

What untoward circumstance, what fatality gave the death blow to the race of mammoths, to the great dinosaurs, or to all or any of those strange creatures which have peopled the earth in the far distant past? Was it a change in climate, or a dearth of food, or perhaps some particularly insidious disease? Probably many causes contributed. Speculations is easy. The scientific way to illumine the past is to apply to it the knowledge gained by a study of the present.

It is not merely from the whimsical standpoint of the collector that rare species have a peculiar interest. A rare animal or plant may be the representative of a species in the process of extinction. This lends a double interest to the case. In the first place, if the species has an economic value, it becomes a problem what can be done to prevent its extermination.

On the other hand, if in a rare species we see a race making its last dying struggle for existence, then here we have material for the study of some of the conditions that may lead to biological extinction.

Such a case, it seems, and one of unsual interest, is reported upon by F. V. Coville in a recent issue of *Science*.

The plant known as the box huckleberry (*Gaylussacia brachycera*), one of the most beautiful evergreen ground covers known to landscape architects, is threatened with extinction. Authentic reports of its occurrence come from only two localities,

the one in Perry County, Pennsylvania, the other from Sussex County, Delaware.

The Pennsylvania field has been carefully unvestigated by Mr. Coville, to ascertain, if possible, the causes for the restricted occurrence of this shrub. The facts brought to light are most interesting.

The plant was found to be confined to a single patch extending from a distance of 400 yards along the slope and shoulder of a hill. The area covered is about eight acres.

Examinations of soil, moisture conditions and exposure showed that these presented nothing peculiar, so that the isolated occurrence could not be ascribed to any such factor as this.

But what is significant is that over the whole area the root mat of the plant was found to be practically continuous. The patch terminates abruptly, without any change in the nature of the soil. In one place a small streamlet, almost dry at times, has formed an effective barrier to the spread of the shrub.

Here, then, is a problem. Mr. Coville suggests a solution which is as interesting in its implications as it is plausible in its nature. The whole patch, according to his explanation, is one plant. For this reason the seeds are sterile, just as self-fertilized seeds of certain related species are known to be sterile. This aspect of the problem has passed the speculative stage. On examination 90 per cent of the seeds proved to be empty shells. Only about 10 per cent contained endosperms. Out of 1,600 seeds sown in November, 1918, only three germinated, and these gave very weak seedlings.

The diagnosis at once suggests the remedy: Find another plant of box huckleberry to cross with the Pennsylvania stock and produce a new, rejuvenated progeny.

This is, indeed, the plan which has been followed. After a number of fruitless efforts, the Delaware patch has been located. Like the Pennsylvania patch it bears all the signs of being one single individual. The two plants have been crossed, but the fruit is not yet ripe.

What is the explanation of this strange survival of two or three isolated patches of the plant? Mr. Coville suggests the following: The plant originally grew in greater abundance in some other, perhaps somewhat remote locality. It became infested with some pernicious disease—as in our day the chestnut has been attacked by the blight—to which it succumbed almost entirely, leaving only a few stragglers that grew out of seeds carried by birds beyond the range of the fatal epidemic.

From the size of the patch Mr. Coville estimates that it is about 1,200 years old.

Here, then, is a romantic episode in plant life: The race is dead, all but for two or three survivors scattered widely over the country.

For 1,200 years the Pennsylvania patch has been patiently waiting for its mate. And now, in the year 1919, by the hand of man, through the "matrimonial agency" of botanical research, there is promise of a new lease of life, of a rejuvenated race of *Gaylussacia brachycera.*

Popularity of Motor Boats in China

MOTOR boats are gaining in popularity among the Chinese, and the time seems not far distant when they will be in far more general use for business and pleasure. It is reported that at least 50 boats are being constructed in the various yards at Canton, and that there is a demand for motor-boat engines developing from 15 to 35 horse-power. While American engines are popular, manufacturers should take into consideration that the Chinese give great weight to the price, rather than basing their purchases solely on quality, especially as European manufacturers undoubtedly will take advantage of this fact in their efforts to capture this growing market.

NEW BOOKS, ETC.

MARE NOSTRUM. (Our Sea.) By Vicente Blasco Ibanez. New York: E. P. Dutton and Company. 8vo.

This epic of the Mediterranean by the author who galloped to fame with "The Four Horsemen of the Apocalypse," tells at once the story of "Our Sea" and the story of Capt. Ulysses Ferragut. A German adventuress—and she is a touch of sheer melodrama—lures the Captain into aiding the U-boats; the U-boats show their gratitude by killing his son. It is not precisely a war story, though the war provides the machinery of the plot. Lovers of Ibanez will find in it the same exhibition of descriptive powers that lends distinction to all his work.

CAESAR'S COMMENTARIES OF THE GALLIC WAR. By Frederick Holland Dewey, A.B. New York: Translation Publishing Company, Inc., 1918. 8vo.; 500 pp.

One of "The Student's Interlinear Translations" series, this book gives the original text form in full, with the equivalent English word printed directly beneath the Latin original. Difficult grammatical constructions are named in parentheses, and in the English the modern forms of the old geographical names are frequently given in brackets. The method avoids both the weakness of a polished interpretation and the vagueness of a translation so minutely exact that a great strain is placed upon our idiom. The purpose is not only to permit the student to acquire a thorough knowledge of the work in the shortest possible time, but more particularly to enable him to appreciate the force and beauty of the original expression.

A SOURCE BOOK OF BIOLOGICAL NATURE STUDY. By Elliott Rowland Downing. Chicago: The University of Chicago Press, 1919. 8vo.; 503 pp.; 338 illustrations.

The dissatisfaction of students is not always to be taken seriously; but when educators and scientists agree with them as to the futility of much that passes for nature study in our schools, it is time to look to our methods. Weeds and flowers of the wayside, common animals and insects and birds, provide material for the problems of this excellent new text, which is a revelation of the marvels of the commonplace. Among its outstanding merits are its efficient planning and its practical applications; it brings order out of chaos in its masterly organization of the subject-matter, interests deeply without the sacrifice of accuracy, and appeals not only to teachers and their pupils, but also to the reading public who like nothing better than to be initiated through increasing familiarity with their environment, into the deeper laws and phenomena of nature.

OLD-FASHIONED VERSES. By William T. Hornaday. New York: Clark and Fritts. 8vo.; 114 pp.; illustrated.

Old-fashioned? Yes, if by that the distinguished Director of the New York Zoological Park refers to the old rhymes and meters that have won their way to all hearts. But his themes are red-blooded, intensely alive, with the spaciousness of the world in them. The war section has a stirring chant royal of the Avenging of Cradduck; other sections glorify wild life, and friendship and love. The lines swing to a balladic lilt, and the full-page plates add to the beauty and attractiveness of the work. The healthy man of action is the one who will find most enjoyment in these songs of sea fighting, untamed nature, and the outdoor life.

ELEMENTS OF RADIOTELEGRAPHY. By Ellery W. Stone, Lieut., U. S. N. R. F. New York: D. Van Nostrand Company, 1919. 8vo.; 267 pp.; 125 illustrations, 33 plates.

Written originally for radio students in the Communication Service of the Navy, this work will prove equally satisfactory in civilian school instruction and for the home student. Its treatment is physical rather than mathematical, and only a knowledge of elementary physics and simple mathematics are necessary to a grasp of the knowledge it conveys. The arrangement is logical, the language plain, while the fine paper, clear print and carefully-made illustrations combine to raise this text far above the many cheap handbooks that deal with this subject.

SINUOUS COURSES AND THE AUTOMATIC COURSE INDICATOR FOR NAVAL WARFARE. By Lindell T. Bates, Ph.B., LL.D. 141 Broadway, New York: The Submarine Defense Association. 4to.; 63 pp.; illustrated.

One of the new arts developed by the war was that of "zigzagging" to avoid torpedoes. The object of these instructions, revised from pamphlets published by The Submarine Defense Association, is to place this art upon scientific and automatic bases, replacing the old zigzag by a carefully determined sinuous spiral course, affording the greatest measure of safety, and carrying the vessel more speedily toward port. The Automatic Course Indicator may be used with both the magnetic and gyroscopic repeater compass and the greatest mechanical precision and time accuracy is assured. The system may also be employed to advantage by battleships, to evade the searchlight, avoid disastrous results from shore batteries, and baffle the attack of an enemy fleet.

DANGER SIGNALS FOR TEACHERS. By A. E. Winship, LL.D. Chicago: Forbes and Company, 1919. 8vo.; 204 pp.

The war has, among other things, modified our views on education and given teachers new problems. These talks with teachers cover thoroughly all danger points that threaten efficiency, in school and out, urge them to think in large units, to regard education as preparedness, to get out of the treadmill, and to learn that responsibility is opportunity. Instances of diplomacy in the handling of children are cited, and apt illustrations of successful principles abound. There are chapters, too, that the parent and the tax payer might read to advantage.

AN INTRODUCTORY COURSE IN QUANTITATIVE ANALYSIS. By George McPhail Smith. New York: The Macmillan Company, 1919. 8vo.; 206 pp.; illustrated.

The necessary preparation for this course is a knowledge of elementary chemistry and qualitative analysis. It gives laboratory directions in sufficient detail to release the instructor from all-absorbing personal supervision and enable him to devote the rescued time and energy to the development of theoretical knowledge and independent thinking. With classroom instruction in mind, it includes such stoichiometrical problems as are constantly arising, and opens up the fundamentals of numerous processes. There are also concrete questions and good general discussions, all contributing to a well-rounded and efficient text.

APPLIED SCIENCE FOR METAL WORKERS. By William H. Dooley, B.S., A.M. New York: The Ronald Press Company, 1919. 8vo.; 479 pp.; illustrated.

The first portion of this work deals with the general principles of all industrial science; the particular knowledge required by the metal worker is dispensed in the succeeding chapters. The whole arrangement is designed to be of equal benefit to science teachers, whether they are in regular secondary and technical schools or in vocational schools. The needs of the intensive method of instruction are adequately met, and the pupil is led quickly to the point where he can look upon a specific operation and trace from it the underlying abstract principles. As an elementary course in applied science for the metal trades the work possesses original features and should develop an alert mental attitude.

THE STRATEGY OF MINERALS. Edited by George Otis Smith. With Introduction by Franklin K. Lane, Secretary of the Interior. New York and London: D. Appleton and Company, 1919. 8vo.; 372 pp.; illustrated.

The Director of the United States Geological Survey has given us a work that treats of our pre-eminent mineral resources from an unusual angle. In war and in peace mineral wealth is potential power; solving the problems of utilization and conservation is the triumph of what the editor aptly calls the strategy of minerals. The work investigates this factor in the world position of our country, its bearing upon international relations, the shipping crisis, fuels, power production, and the chemical industries. The broad-visioned foreword of the Secretary of the Interior is in his happiest vein, a summary that goes directly to the point. Chapters on the main groups of mineral raw materials are furnished by recognized authorities. The information is arresting, of a vitally necessary character, and of universal application.

SUCCESS IN A NEW ERA. By James J. Walsh, M.D., Ph.D., Sc.D. Hoboken, N. J.: Franklin-Webb Company, 1919. 12mo.; 152 pp.

The author attributes American success in the late war to morale, which he defines as will power and confidence in self. His book shows how this force may be accumulated and applied to the problems of peace, and how the individual may fight his way to legitimate success while enjoying every minute of the conflict. Increased output from tapping the deeper layers of energy, converting this energy into action, and directing this action into channels that lead to a definite end, are considerations that mark the inspiring chapters of the little work.